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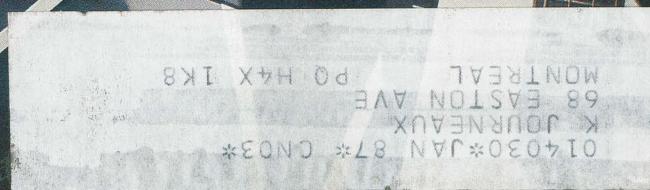
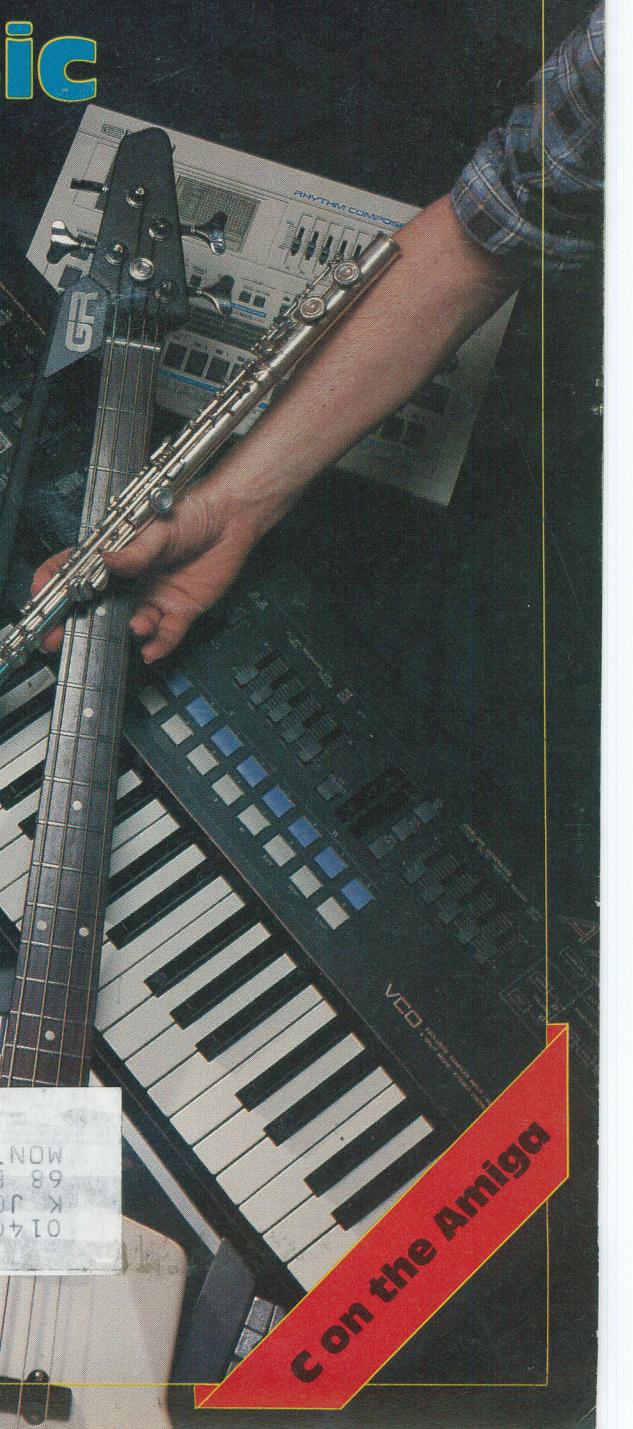
Canada's Personal Computing Magazine

April 1986

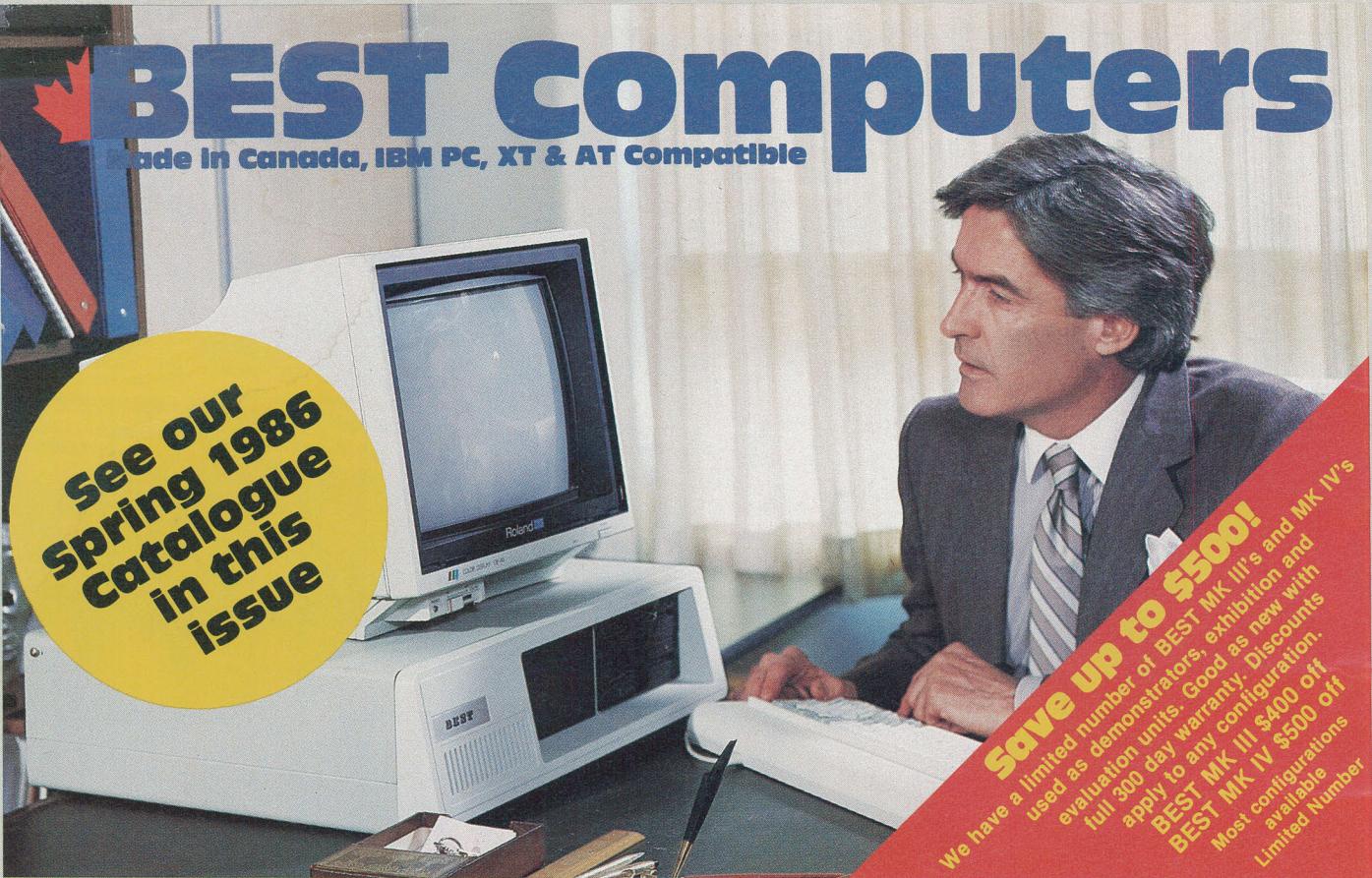
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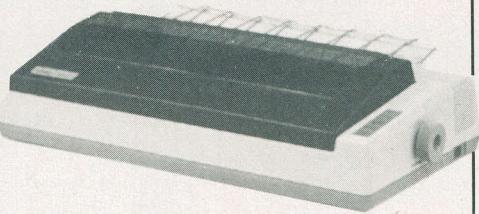
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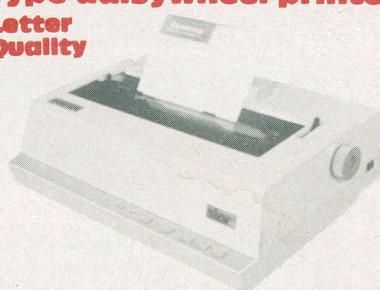
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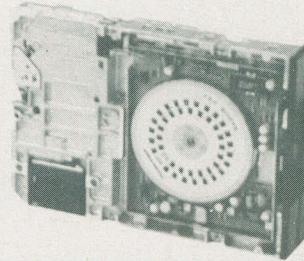
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# Computing Now!

Volume 4 No. 1  
April 1986

*Canada's Personal Computing Magazine*

The cover photograph was executed by Bill Markwick. Thanks to Steve's Music, 415 Queen Street West, Toronto, Ontario M5V 2A5 for The Yamaha DX-7. Also seen are the Roland G-77 MIDI bass, the Roland TR-727 rhythm composer, the Atari AX60 synthesizer, and an old Artly flute.

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## Stray Bits

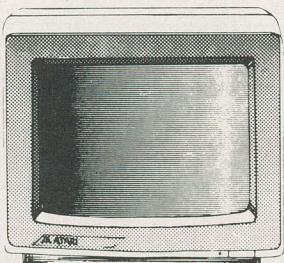
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# COMPUTER PRESS

by Marie Hubbs

## News

JMG Software International recently announced a new division, STari Distributing, which will specialize in software for the Atari ST. David Thompson, the ST Distribution Manager, believes that "all the ST needs is the software to make it the most popular personal computer on the market today. The idea... is to make available the latest and most innovative software titles that might otherwise not be seen on Canadian shelves."

STari Distributing is located at 801 Mohawk Road West, Hamilton, Ontario L9C 6C2, telephone (416) 575-3200.

Pixar, the computer graphics division of Lucasfilm, has recently been acquired by Steven Jobs (remember him?) and the employees of Pixar for an undisclosed sum in the millions. As an independent company Pixar will design, manufacture and market high performance computers and software specifically tailored for state of the art computer graphics and image processing applications. Ready for market now is a minicomputer, the Pixar Image Computer, selling for approximately \$125,000 US.

## Batch Patch

In case you were wondering, here's the address for more information on the Extended Batch Language reviewed in last month's issue: Seaware Corporation, P.O. Box 1656, Delray Beach, Florida 33444, telephone (305) 276-5072.

## New Products

### STill More

Atari has just announced the 1040ST, which features built in CPU, keyboard, power supply and one double sided, double density three and a half inch disk drive. With over one megabyte of memory, the 1040ST comes equipped with ST BASIC, 1st Word for word processing, NEochrome... a graphic art painting program... and VT52 for terminal emulation in telecommunications.

Including an RGB colour monitor, it costs \$1,900.00, and with a high resolution monochrome monitor the cost is \$1,600.00. Like the 520ST, the 1040ST will be distributed by regular Atari dealers. For further information, contact Atari Canada, Public Relations Office, Panache Productions, 2220 Midland Avenue, Unit 61, Scarborough, Ontario M1P 3E6, telephone (416) 291-3005.

Circle No. 5 on Reader Service Card



## Hard Disks

ComputerLand recently introduced a ten megabyte, portable hard disk for IBM PCs, XTs and compatibles. Any number of portable hard disks can be used in one computer, or shared among many to increase storage capacity and system flexibility, and sensitive or confidential data can be locked away from the computer terminal area to provide extra security.

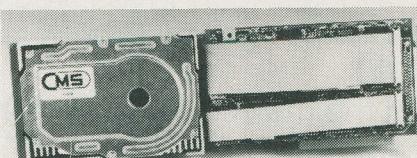
A complete system, including the hard disk, an internal control board, mounting bracket and docking port, will retail for just under seventeen hundred dollars. The Sysdyne! portable hard disks will be available only from your local ComputerLand store, or ComputerLand Canada, 2000 Clark Boulevard, Brampton, Ontario L6T 4M7, telephone (416) 793-9000. Circle No. 6 on Reader Service Card



Three models of twenty megabyte, three and a half inch hard disk drives on add-in cards have been announced by CMS for IBM PCs, XT's and compatibles. The CMS Drive Plus family will enable users of MS-DOS microcomputers to add internal hard disks to systems already containing a full complement of disk or tape drives. Depending on specifications, prices will range from \$595 US to \$745 US.

For further information and local availability, contact CMS at 401-B West Dyer Road, Santa Ana, California 92707, telephone (714) 549-9111.

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## New Software

Connector, a software package which allows a VENIX/86, an enhanced UNIX system, to run DOS applications, was recently launched by Software Kinetics. Providing an invisible bridge between the multi-tasking capabilities of VENIX/86 and such popular DOS applications as WordStar, dBASE III and Lotus, Connector allows the processing of VENIX/86 tasks in the background, while running DOS applications.

Listing for just under five hundred dollars, Connector is available from Software Kinetics, 3 Amberwood Crescent, Nepean, Ontario K2E 7L1, (613) 226-6792.

Circle No. 9 on Reader Service Card

Continued on page 75

## Next Month In

**Computing Now!**  
Canada's Personal Computing Magazine

## Telecommunications

There has been a lot of development in telecommunications software and hardware in the past few months. There are new modems to contend with, a couple of peculiar protocols that have been cropping up... and the general confusion that seems to happen every time two or more computers with serial ports are put together on the same continent. In the next edition of Computing Now! we will be looking at the business and personal applications of this powerful aspect of microcomputer technology.

## Unix

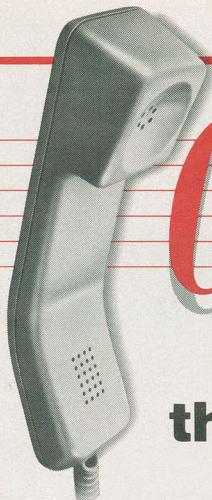
The perennially weird operating system is making its way... reluctantly... into micros. Next month we'll have a look at some of the practical realities of Unix-like working environment on personal computers.

## Dogs for Breakfast

The serial port management facilities that the IBM PC offers one as part of its BIOS are poodles of the first order if you envisage communicating at much above a turtle's pace. That's a chocolate turtle. Next month we're going to have a peek at interrupt driven serial ports. They're eminently possible on the PC and they solve a host of telecommunications nasties.

These features are in an advanced state of preparation. However, in endeavouring to keep Computing Now! as up to the minute as possible we reserve the right to change the contents of this issue prior to going to press.

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# Yamaha SFG-05 CX5M Synthesizer Module

The CX5M music computer always seemed to have a lot of potential... and almost enough power to achieve it. This little box juices it up.

by Steve Rimmer

Computer music toys have a characteristic ability to look decidedly un-musical... and none more so than the SFG-05. Not even really an instrument or a complete entity at all, the SFG-05 is designed to plug into the Yamaha CX5M computer as replacement for the funky and largely unworkable SFG-01 FM synthesizer module. Owners of CX5Ms with the earlier modules may well fume over this... upgrading to the now wholly functional SFG-05 is anything but cheap. However, the facilities that this little box gives the CX5M are quite the party, and, depending upon the limit of your plastic, worth the cost.

While the earlier implementation of the

synthesizer module made the CX5M into little more than a small computer with a rather nice noise maker, the SFG-05 turns it into an instrument. More to the point, it gives it all sorts of capabilities which fit it comfortably into the gaps that grow in most MIDI systems.

## Poly Wanna Cracker

Plugging in the SFG-05 is fairly easy. You need only remove one bolt, slide out the old module and plug in the new one. The next hardest part is dropping a couple of hundred bucks worth of technology in a drawer, never to be used again. In fact, because of the arrangement under which Yamaha is orchestrating this aspect of the

cotillion, most owners of old modules will probably wind up having the swap done by their dealers.

When you boot the CX5M with the new module it will behave pretty much as it always did. However, if you type CALL MUSIC to access the music program which normally lives in the SFG module, the screen will be totally different. Whereas the old module's software was ginchy and a bit incomprehensible... and mostly useless... the program for the SFG-05 is a masterpiece of forethought and versatility. It supports all the stuff there is to support and even does moderately decent graphics to show you what's happening.

The principal screen is a picture of a DX

## **Yamaha SFG-05**

style keyboard synthesizer with a sheet of paper sticking out of it. If you do anything to change screens... usually through the function keys... the paper scrolls down into the synthesizer and a new one scrolls out. It is a bit overdone, I suppose, but it's neat none the less, and bespeaks someone having spent some time on *this* version.

The actual FM synthesizer in the SFG-05 is essentially similar to that of the SFG-01. It does eight DX-9 type algorithmic voices. These are four operator voices, as opposed to those of the DX-7, which use six. This... translated into shorter words... means that the voices aren't quite as interesting or rich as those of the more involved DX-7. They're still extremely good, though, and have the side advantage of being a bit easier to edit.

The module has forty-six preprogrammed voices... actually, there are forty-eight, but the last two are silent. These appear to live in firmware... in any case, they can't be altered. They've been reasonably well selected. More to the point, they're pretty good voices. Among the interesting aspects of them is the flute, which includes breath noises if you play it in its lower registers.

There is also room for forty-eight user defined voices, which one can load from a tape or one of the newly released floppy disk drives for the CX5M if you have one. I've actually just received one... as I'll get to in a moment, the disk drive and the SFG-05 are rather interrelated. We'll look at the changes the drive makes in the capabilities of the CX5M in another article.

The SFG-05 allows for four MIDI channels coming into it, which can be assigned to any logical channel you feel like having them listen to. Each channel can play up to eight voices, but as the module has only eight voices in total, having the four channels assigned to different channel numbers will mean that each one can only play two notes at a time. The channel assignment capabilities of the module are pretty decent.

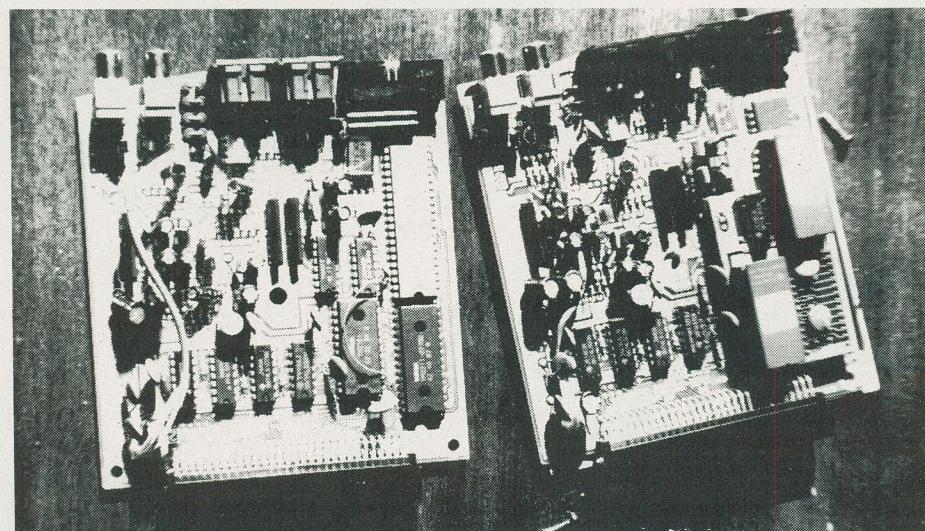
The main screen of the internal software gives one complete control over the voices, what they do and what they're supposed to sound like when the module is being played either through an external MIDI device or through a dedicated organ keyboard, like a YK-10. There's a jack for a keyboard right next to the MIDI ports on the side of the module.

In use, the four arrow keys on the CX5M do most of the work. The cursor up and down arrows move a pointer along the left edge of the page. If you try to cursor past the bottom of the page everything scrolls up. There are actually three pages of stuff available in the SFG-05's main mode.

When the module first comes up all four MIDI channels are set to channel one and will play the EORGAN internal voice. Moving the pointer so that it's looking at one of

these and hitting the left or right arrow keys will allow one to cycle through the internal voices... the names change on the screen as they clip by. You can actually do this while a piece is playing through the little box without so much as an audible hiccup as a new voice is selected. This is a decent bit of

the page affect all four voices... if you lay heavy vibrato on the first voice because it's set to being strings you'll also have it on all the other three... a drag if you have the second voice being a harpsichord, for example. Harpsichords simply don't vibrate... at least, not unless you live on the West coast.



**The fog lifted: the old module (left) and the new one (right). Note the new firmware on a piggyback board.**

engineering, even compared to some of the really expensive hardware, such as the DX-7, which burps noticeably if you casually change its voices.

Scrolling down the page, each of the four channel volumes can be set independently. There's a sixteen level scale which, again, is adjusted by zapping the left and right arrow keys of the CX5M.

Both of these parameters can be changed through the MIDI port, of course. They respond to the normal MIDI messages exactly as one would expect them to.

The next thing down the page is one of the most potentially useful features of the new module if you plan to play it through a keyboard... either a YK-10 type keyboard plugged into the appropriate jack or a MIDI keyboard... or other MIDI instrument... plugged into the MIDI port. It allows one to define the split keyboard which will play the first two voices. You can select where along the span of the keyboard you want the split to occur. You can also define which two voices you want the two halves of the split keyboard to play and whether they should be transposed... you can move each of 'em up or down an octave if you want to. This allows, for example, one to play a rhythm harpsichord track with one hand and a lead flute track with the other.

One can also preset the MIDI sustain on or off from this page. The sustain on mode is only useful for a few things... it sustains for a long time in practice. Scrolling down a few lines, the vibrato and tremolo of the voices can be adjusted. The only catch to this is that the settings one lays on this section of

### **Please Sir... More Modes**

The SFG-05 module has a small sequencer built into it. If you hit the delete key followed by the insert key it will start recording what gets played on it... either through the MIDI port or through a YK-10 type keyboard. It has a capacity of about eighteen hundred notes, or somewhat fewer if there's a disk drive in the system. Recorded tracks made with the sequencer can be played back in other voices if one wants to meddle with them, and their basic parameters, such as tempo and transposition, can be altered. The recorded tracks can be saved to tape or the disk drive.

This isn't exactly Personal Composer, but it's reasonably tight as simple sequencers go.

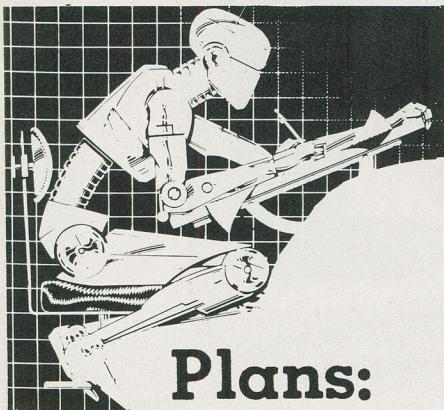
Finally, if one has a YK-10 type keyboard attached to the module it will do auto bass chords. In this mode, one hits the lowest octave of keys to play a kind of instant bass line. I didn't get to try this feature, as I didn't have a suitable keyboard. Sounds really ghastly, though. I suppose it depends on what you're up for playing.

The ultimate usefulness of the new module in the CX5M will be determined by exactly what you want to play on it. If you're using the CX5M entirely as a computer, generating sounds programmatically, it's not really worth the effort. The old module will do as well... er, with one catch, which we'll get to in a moment.

If you want to play the CX5M as an instrument through one of its dedicated keyboards, the new module will make it infinitely more useful. It adds all sorts of new

## **Yamaha SFG-05**

features, and will probably blow you away with its versatility and possibilities. The same is true if you want to play it through an external MIDI keyboard.



### **Plans:**

|                 |  |
|-----------------|--|
| Hardware:       | <b>SFG-05 FM synthesizer module</b>  |
| System:         | <b>Yamaha CX5M Music Computer</b>  |
| Facilities:     | MIDI in and out, YK-10 type keyboard interface, stereo sound out, 48 preset voices, 48 programmable voices, eight note polyphony, four MIDI channels, internal software. |
| Manufacturer:   | <b>Yamaha</b>  |
| Available from: | XElectronix Computer Music Centre, 317 College Street, Toronto, Ontario M5T 1S2, telephone (416) 921-38941.  |
| Price:          | <b>\$250.00</b>  |

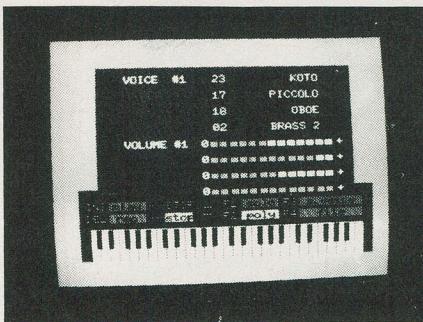
**Circle No. 37 on Reader Service Card.**

Finally a lot of potential users of the CX5M with the SFG-05 will see it as a cheap way to get eight first rate MIDI voices for use with other things. I've been having a fine time using it as a four channel sound source played through Personal Composer on the IBM PC. It is a tad inconvenient as this... one must boot the little computer, run the MUSIC program and set up a number of things every time one wants to play something on it. However, the phenomenally low cost of the CX5M... even if you have to spring for the new box... as opposed to, say eight TX-7s... does make these little tribulations seem inconsequential.

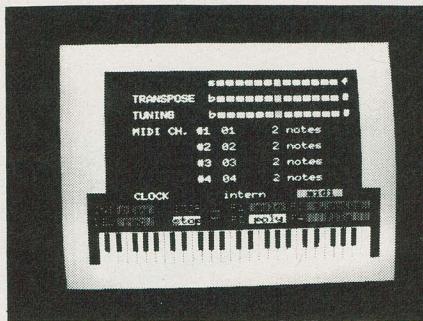
I should note the other hook buried in the new module... it doesn't affect its use once you've got it... probably... but it may do in a few things if you elect not to buy it. Very simply, the new Yamaha CX5M floppy disk, splendid bit of technology that it is, won't work on a CX5M equipped with an old module. You have to buy the new module if you want to buy the disk. The dealers who sell all this plastic have some sort of arrangement which makes this a bit less expensive than it might otherwise be if

you were to buy them both separately... check into all this.

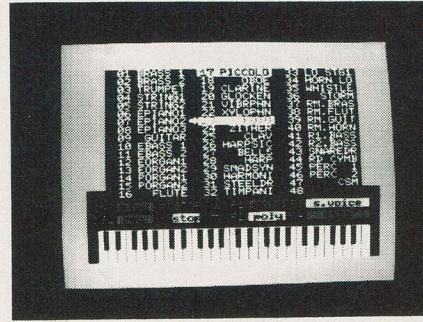
The flip side of this catch is that the ROM based software cartridges which were released for use with the CX5M when the old module was still the state of the art are of



varying usefulness with the new module in place. As far as I can tell they all seem to work in their new surroundings, but they weren't written to save things to the disk,



and, as such, fail to recognize its mere existence. If you want to be able to save things from the plug in music programs to the disk drive you pretty well have to replace them, too.



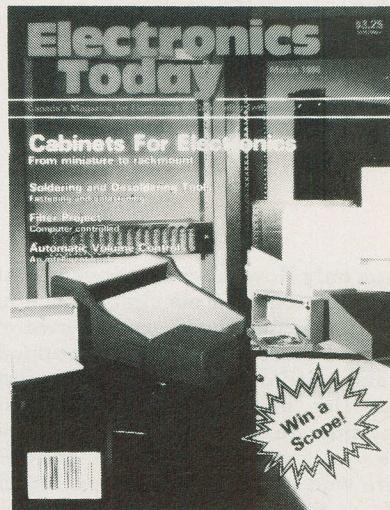
This is, methinks, the epitome of excruciatingly bad planning.

The financial nastiness of the new module is probably something you'll have to reconcile with your own Visa card. Its technological splendour, however, is inarguable. It's a cosmic party of the first order, and an asset to almost any sort of MIDI music.

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# The Second MIDI Music Survey

It was only November of last year that we pulled together our first collection of MIDI-related hard and software, but since then new ones have popped up like weeds... we're not saying what kind. Not everything listed has a Canadian distributor yet, but by the time you read this... who knows? There was still information pouring in at press time, so check out Computer Press in future issues for updates.

by CN Staff



## Alfred's Computer Music Software series

**Description:** Various software packages designed for self-directed learning. Includes titles like Basic Band Computer Tutor; Practical Theory; Music Achievement Series; and Music Made Easy.

**Computer(s):** Apple II and Commodore 64  
**Retail Price:** \$40 to \$275  
**Manufacturer:** Alfred Publishing  
**Availability:** Waterloo Music

## Algorithmic Composer

**Description:** This is a collection of three programs designed for the experimental composer.

**Computer(s):** Apples, Commodores  
**Hard/Software Req:** Keyboard Controlled Sequencer, disk drive, interfaces.  
**List Price:** \$100.00 US Commodore 64; N/A Apple  
**Manufacturer:** Dr. T's Music Software  
**Availability:** Dr. T's Music Software

## AX-60 Six Voice Polyphonic Synthesizer

**Description:** This sixty-one keyed, five octave split keyboard has sixty-four sound programs and eight split presets.

**Computer(s):** Any MIDI equipped computer  
**Hard/Software Req:** MIDI interface  
**Retail Price:** \$1,395.00  
**Manufacturer:** Akai Audio Video Canada  
**Availability:** Akai

## AXIS-1 Remote Keyboard

**Description:** Exclusively designed to control MIDI sound producing units, the AXIS-1 is compatible with all Roland and non-Roland instruments.

**Price:** \$995.00  
**Manufacturer:** Roland Canada  
**Availability:** Steve's Music

## The Bare Facts series

**Description:** Designed to teach, test and evaluate through progressively challenging lessons and games on disks, the series covers topics such as Notes, Rhythms and Terms; Chords and Intervals; Music History; and Composers.

**Computer(s):** Apples  
**Hard/Software Req:** One disk drive, monitor, 64K RAM  
**Retail Price:** \$42.00 to \$110.00, depending on package  
**Manufacturer:** Waterloo Music Limited  
**Availability:** Waterloo Music

## Casio Editor/Programmer/Librarian

**Description:** Complete instrument voicing system for the Casio (CZ 101, 1000, 3000 and 5000), with interactive editor and ten banks of patches.

**Computer(s):** Apple II+ and Ile, Commodore 64/128  
**Hard/Software Req:** MIDI interface  
**Retail Price:** \$249.00  
**Manufacturer:** Syntech Corporation  
**Availability:** Kaysound Imports

## Chroma MIDI Converter

**Description:** A complete MIDI implementation for the Rhodes Chroma, featuring sixteen programmable MIDI functions and complete compatibility with the Fender/Apple Music System.

**Retail Price:** \$749.00  
**Manufacturer:** Syntech Corporation  
**Availability:** Kaysound Imports

## CX5M Software Programs

**Titles:** YRM-101 FM Music Composer.  
YRM-102 FM Voicing Program.  
YRM-103 Voicing Program.  
YRM-104 FM Music Macro.  
**Price:** \$59.99 each  
**Titles:** YRM-301 MIDI Recorder.  
YRM-302 RX Editor.  
YRM-304 DX7/TX7/TF1 Voicing Program, disk version.  
YRM-305 DX21 Voicing Program, disk version.  
YRM-501 FM Music Composer Mark II, disk version.  
YRM-502 FM Voicing Program, disk version.  
YRM-504 FM Music Macro Mark II, disk version.  
CMW-031 Keyboard Chord Master.  
CMW-032 Keyboard Chord Progression.

CMW-033 Guitar Chord Master.  
\$79.95 each  
CX5M  
Yamaha Canada  
Steve's Music

# MIDI Music Survey

## CX5M Music Computer

**Description:** A computer, specifically designed for musicians, composers and arrangers, the CX5M has available forty-six preprogrammed eight polyphonic FM voices as well as its own subset in monophonic form, all of which can be played in any combination; the basic voices can be altered, or new voices programmed, and any performance can be recorded and played back; there are also automatic bass, rhythm and chord features; via the MIDI interface, the CX5M allows you to program the DX synthesizer.

**Hard/Software Req:** FM Sound Synthesizer, YK-01 or YK-10 keyboard, video monitor with built-in speaker, or any audio system or music instrument amplifier.

**Price:** \$695.00  
**Manufacturer:** Yamaha Canada  
**Availability:** Steve's Music

## CZ Patch Librarian

**Description:** Software tool for the creation, editing and storage of patches on the Casio CZ-101, -1000 and -5000 synthesizers.

**Computer(s):** Apples, Commodores, Atari 520ST

**Hard/Software Req:** Disk drive, interfaces.  
**List Price:** \$120.00US Apple; \$95.00US Commodore 64; Atari N/A

**Manufacturer:** Dr. T's Music Software  
**Availability:** Dr. T's Music Software

## DDR-30 Digital Drums System

**Description:** Module includes two kinds of drum pads, for six drum voices...bass, snare, and toms...and can give the equivalent of ninety-six separate six voice drum kits.

**Price:** \$2,945.00  
**Manufacturer:** Roland Canada  
**Availability:** Steve's Music

## Deep Magic sound library series.

**Description:** This is a set of sound libraries for all Korg synthesizers (except Trident), SCI Prophet-600 and Moog Source.

**Computer(s):** Optional  
**Hard/Software Req:** Synthesizer, cassette player  
**Retail /List Price:** \$30.00US to \$60.00US

**Manufacturer:** Deep Magic Music  
**Availability:** Deep Magic Music

## Drumpulse

**Description:** A library of seven different rhythm programs for various drum computers, such as the Yamaha RX-11 and RX-15, Sequential Drum Traks, Tom, Korg Super Drums, and Roland TR-707.

**Computer(s):** N/A  
**Hard/Software Req:** Cassette recorder  
**Retail Price:** \$14.95 US each

**Manufacturer:** Drumpulse  
**Availability:** Drumpulse

## DX-Archive

**Description:** DX-7 voice librarian and management package. Facilitates creating performance groups from several libraries conveniently. Moves voice banks to and from the DX-7 with no button pushing.

**Computer(s):** IBM PC, XT, AT and compatibles.  
**Hard/Software Req:** DOS 2.0 or better

**Retail Price:** \$39.95  
**Manufacturer:** Alchemy Mindworks  
**Availability:** XLelectronix Computer Music Centre

## DX-1 Sound Sampling System

**Description:** Samples and reproduces ordinary sound under computer control, which allows either preprogrammed or user created patterns. Includes circuit board, cable, manual and Effects II software with twenty-two prerecorded sounds.

**Computer(s):** Apple II+, IIe or III, Franklin  
**Hard/Software Req:** One disk drive  
**Price:** \$349.00 US  
**Manufacturer:** Decillionix  
**Availability:** Decillionix

## DX-7

**Description:** A MIDI keyboard and music system, the DX-7 has thirty-two internal voices and features sixteen note polyphony.

**Computer(s):** Any computer with MIDI interface  
**Price:** \$2,095.00  
**Manufacturer:** Yamaha  
**Availability:** XLelectronix Computer Music Centre

## DX-100

**Description:** A "digital programmable algorithm synthesizer", with four operators and editable preset voices, the DX-100 is a scaled down version of the DX-7.

**Computer(s):** Any computer  
**Hard/Software Req:** MIDI interface  
**Price:** \$560.00  
**Manufacturer:** Yamaha  
**Availability:** XLelectronix Computer Music Centre

## DX Patch Librarian V2

**Description:** This special purpose software tool was designed to simplify the creation and storage of patches for the Yamaha DX synthesizers, and will also permit the programming of TX and 8-16 expansion modules without a DX7.

**Computer(s):** Apples, Commodores  
**Hard/Software Req:** Disk drive, interfaces.  
**List Price:** \$100.00US Commodore 64;  
\$125.00US Apples

**Manufacturer:** Dr. T's Music Software  
**Availability:** Dr. T's Music Software

## DX-TX EZ Voice

**Description:** Programming librarian software using colour graphics, and including up to 110 pre-programmed sounds.

**Computer(s):** IBM PC  
**Hard/Software Req:** Yamaha DX-7 or TX module, Syntech MIDI interface.

**Retail Price:** \$675.00  
**Manufacturer:** Syntech Corporation  
**Availability:** Kaysound Imports

## EM-101 Sound Plus

**Description:** A compact, eight-voice polyphonic MIDI sound module especially for use with MIDI compatible Piano Plus electronic pianos, the EM-101 offers sixteen preset sounds, eight ensemble and eight solo; attack and velocity sensitivity can be controlled using slider controls.

**Price:** \$550.00  
**Manufacturer:** Roland Canada  
**Availability:** Steve's Music

## Emulator II

**Description:** A polyphonic digital sampling keyboard with a five octave, sixty-one key range, and up to sixty programmable splits. One double sided, double density disk drive included.

**Computer(s):** Any MIDI equipped computer.  
**Hard/Software Req:** Second drive or Winchester hard drive optional.

**Price:** Approximately \$8,000.00US  
**Manufacturer:** E-mu Systems  
**Availability:** E-mu Systems

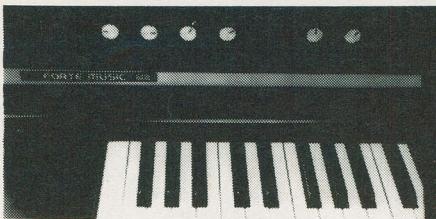
## Forte MIDI-Mod

**Description:** An internally-installed modification, Forte MIDI-Mod allows you to control any MIDI-compatible synthesizer, sequencer accessory directly from the keyboard of an acoustic or electric grand piano.

**Price:** \$625.00 PF-15 electric piano,  
\$2,300.00 acoustic piano.

**Manufacturer:** Forte Music, Dale Robertson's Piano Services

**Availability:** XLelectronix Computer Music Centre



## 48 Track PC MIDI Recorder

**Description:** Using all expansion memory in the computer, this Recorder allows you to work on thirty-two separate pieces of music at once, and allows saving recorded pieces in ASCII format.

**Computer(s):** IBM PC and compatibles  
**Hard/Software Req:** Monochrome or colour monitor, Syntech MIDI interface.

**Retail Price:** \$799.00  
**Manufacturer:** Syntech Corporation  
**Availability:** Kaysound Imports

## Genesys I Digital Synthesizer Board

**Description:** A powerful sixteen oscillator sound synthesis system, the Genesys is compatible with Classic/Alpha/Syntauri keyboards and Proxima software.

**Computer(s):** Apple II  
**Price:** \$1,465.00

**Manufacturer:** Mimetics

**Availability:** Classic Organ

## GR-700 Guitar Synthesizer System

**Description:** The polyphonic synthesizer with MIDI outjack combines the expressiveness of the electric guitar with the flexibility of the keyboard synthesizer; it can memorize up to sixty-four different sounds, and has String Select, Dynamics and complete Chromatic Scale functions.

**Price:** \$2,995.00  
**Manufacturer:** Roland Canada  
**Availability:** Steve's Music

## Graphic Artist (GAR-01)

**Description:** Can be used with mouse or from keyboard.

**Computer(s):** CX5M or any MSX computer

**Hard/Software Required:** MSX Mouse optional.  
**Retail /List Price:** \$99.95  
**Manufacturer:** Yamaha  
**Availability:** Steve's Music

## Juno-106

**Description:** This sixty-one key, six-voice, polyphonic synthesizer accepts all MIDI information, allowing several MIDI devices to be controlled simultaneously; all instrumental parts of a composition can also be performed using the data stored in a computer.

**Price:** \$1,695.00  
**Manufacturer:** Roland Canada  
**Availability:** Steve's Music

## JXPress

**Description:** Programming, editor, librarian software for Roland's JX8P synthesizer, which is a complete instrument voicing system featuring four banks of patches, loop recorder and auto-search.

**Computer(s):** Apple II+ and IIe, Commodore 64/128  
**Retail Price:** \$249.00  
**Manufacturer:** Syntech Corporation  
**Availability:** Kaysound Imports

## Keyboard Controlled Sequencer

**Description:** This sequencer includes a complete editing system, a flexible set of options for structuring music and real-time control from the computer keyboard.

**Computer(s):** Apples, Commodores  
**Hard/Software Req:** Disk drive, interfaces.  
**List Price:** \$150.00US Commodore 64;

**Manufacturer:** Dr. T's Music Software  
**Availability:** Dr. T's Music Software

## Keyboard Controller

**Description:** Allowing one master keyboard to slave MIDI instruments on any of sixteen available MIDI channels, this Controller provides three levels of operation.

**Computer(s):** Commodore 64  
**Hard/Software Req:** Syntech MIDI interface  
**Retail Price:** \$299.00  
**Manufacturer:** Syntech Corporation  
**Availability:** Kaysound Imports

## Lehrware Sounds Library

**Description:** One hundred new sounds, sampled and synthetic, including orchestra strings, orchestra winds, exotic, bells, voices, natural sounds, solos drums and FM.

**Computer(s):** Classic Music Computer system  
**Price:** \$150.00  
**Manufacturer:** Paul D. Lehman  
**Availability:** Classic Organ

## Master Tracks

**Description:** Real time, step time and song mode sequencing all in one program, Master Tracks controls MIDI keyboards, voice modules and drum machines.

**Computer(s):** Apple IIe and IIc, Commodore 64  
**Hard/Software Req:** Passport MIDI interface  
**Retail /List Price:** \$379.50  
**Manufacturer:** Passport Designs  
**Availability:** B.J. Music

## ME-10D Delay Unit

**Description:** Creating a digital delay free of analogue conversion, the ME-10D delays signals up to 1,000 ms.

**Computer(s):** Any MIDI equipped computer  
**Hard/Software Req:** Interface  
**Retail Price:** \$249.00  
**Manufacturer:** Akai Audio Video Canada  
**Availability:** Akai

## MIDI Music Survey

### ME-15F MIDI Fader

**Description:** A multifunction support unit, the ME-15F can vary the dynamics between various source and delay signals, and can also be used as a channel checker.

**Computer(s):** Any MIDI equipped computer  
**Retail Price:** \$249.00  
**Manufacturer:** Akai Audio Video Canada  
**Availability:** Akai

### ME-20A Arpaggior

**Description:** You can play up to 128 notes in either direction, and can also sequence your arpeggios.

**Computer(s):** Any MIDI equipped computer.  
**Retail Price:** \$249.00  
**Manufacturer:** Akai Audio Video Canada  
**Availability:** Akai

### Metawave

**Description:** A utility program containing a variety of sophisticated soundmaking tools, allowing complex waveforms to be designed, manipulated, listened to in real time, and stored for use in other Classic programs.

**Computer(s):** Classic Music Computer system  
**Hard/Software Req:** ADA Digital Sampling card suggested  
**Price:** \$150.00  
**Manufacturer:** Paul D. Lehman  
**Availability:** Classic Organ

### MG-1212

**Description:** A twelve channel mixer and recorder, the MG-1212 features the SGX Multi-Channel Head and DBX dynamic noise reduction system, and uses half-inch audio cassette tape.

**Computer(s):** Any MIDI equipped computer.  
**Retail Price:** \$10,500.00  
**Manufacturer:** Akai Audio Video Canada  
**Availability:** Akai

### Micro Floppy Disk Drive (FD-05)

**Description:** Using a three and a half inch, double sided, double density micro floppy disk, with MSX-BASIC built-in, this plug in drive replaces the cassette player as a storage device.

**Computer(s):** CX5M  
**Hard/Software Req:** Interface (FD-051) \$200.00  
**Retail Price:** \$495.00  
**Manufacturer:** Yamaha Canada  
**Availability:** Steve's Music

### MIDI Music Tutor

**Description:** Educational software from beginning to advanced, including chords and intervals, and a records keeper.

**Computer(s):** Apple IIe  
**Hard/Software Req:** Passport MIDI Interface  
**Price:** \$349.50 complete set  
**Manufacturer:** Passport Designs  
**Availability:** B.J. Music

### MIDI Sampler

**Description:** For Baroque masterpieces, easy record-playback gives instant accompaniment for jamming, contrapuntal lines or any one-track part.

**Computer(s):** Apple IIe or Commodore 64  
**Hard/Software Req:** MIDI synthesizer plus interface.  
**Price:** \$59.50  
**Manufacturer:** Passport Designs  
**Availability:** B.J. Music

### MIDI Song Albums

**Description:** Letting you hear and play along with your favourite music using a MIDI synthesizer, these albums use complete, full voice arrangements and accompany them with colour graphics on the video screen; titles include The Beatles, and Pops.

**Computer(s):** Apple IIe or Commodore 64  
**Hard/Software Req:** Colour video monitor; synthesizer;  
**Price:** \$59.50 each  
**Manufacturer:** Passport Designs  
**Availability:** B.J. Music

### MIDI Studio

**Description:** A MIDI sequencer for first-time buyers, this package features many capabilities of the advanced Studio I.

**Computer(s):** Commodore 64  
**Retail Price:** \$149.00  
**Manufacturer:** Syntech Corporation  
**Availability:** Kaysound Imports

### MIDI Voice Librarian

**Description:** Loading up to four banks of thirty-two sounds and any moment directly from software, the Voice Librarian stores and recalls individual sounds as well as whole banks.

**Computer(s):** Apple IIe, Commodore 64, IBM  
**Hard/Software Req:** MPU-401 interface  
**List Price:** \$109.00  
**Manufacturer:** Passport Designs  
**Availability:** B.J. Music

### MIDI/4 Plus

**Description:** MIDI software on disk which lets you design your own recording studio; interface all MIDI synthesizers and any drum machine to most popular personal computers; multi-track recording with unlimited overdubs, real-time editing, transposition, external sync and tempo control.

**Computer(s):** Commodore 64 or Apple IIc and IIe  
**Hard/Software Req:** Passport interface  
**Price:** \$199.50  
**Manufacturer:** Passport Designs  
**Availability:** B.J. Music

### MidiCom

**Description:** Allows you to transmit synth patches and sounds over a telephone.

**Computer(s):** Atari  
**Hard/Software Req:** Any Atari modem  
**Price:** Call for price  
**Manufacturer:** Hybrid Arts  
**Availability:** Steve's Music

### MIDIMAC Patch Librarian series

**Description:** Software available for Yamaha DX, TX or RX, Roland Juno-106 and others.

**Computer(s):** Macintosh  
**Price:** Approximately \$100.00  
**Manufacturer:** Opcode Systems  
**Availability:** XElectronix

### MidiPatch

**Description:** Allows the musician to store custom patches to disk from Yamaha DX/TX and Casio CZ keyboards.

**Computer(s):** Atari, Commodore and IBM  
**Price:** \$108.00  
**Manufacturer:** Hybrid Arts  
**Availability:** Steve's Music

### MidiTrack III

**Description:** A sixteen polyphonic, multifunction track MIDI recorder, synchronizer and MIDI remote control, Miditrack II works with MIDI and non-MIDI drum machines, sequencers or tape.

**Computer(s):** Atari  
**Hard/Software Req:** Hybrid Arts Atari interface (\$295.00), and any MIDI equipped keyboard,  
**Price:** \$450.00  
**Manufacturer:** Hybrid Arts  
**Availability:** Steve's Music

### Mirage Digital Sampling Keyboard

**Description:** With an on board sequencer and multi-overdub ability, the Mirage can play or record from external MIDI equipment.

**Computer(s):** Apple IIe  
**Hard/Software Req:** 64K with 80 column card, monochrome monitor, one disk drive, Passport-compatible Apple/MIDI card, two MIDI interconnect cables.  
**List Price:** \$2,795.00 (\$2,395.00 rack mountable)  
**Manufacturer:** Ensoniq  
**Availability:** Kaysound

### MKB-series MIDI Keyboard Controllers

**Description:** These controllers allow MIDI channels to be assigned individually for the upper and lower parts, as well as the operation mode, and can store up to 128 programs for settings of all controls on the front panel except the Bender.

**Price:** \$1,350.00 for #200, \$1,750.00 for #300, \$3,495.00 for #1000.  
**Manufacturer:** Roland Canada  
**Availability:** Steve's Music

### MKS-7 Super Quartet

**Description:** A sophisticated MIDI sound module, the MKS-7 consists of a two-voice polyphonic melody section, a four-voice polyphonic chord section, a monophonic bass section, and a

rhythm section, all of which respond to MIDI velocity messages; combining the MKS-7 with a computer through the MPU-401 MIDI Processing Unit, any form of music can be created in any desired way.

**Price:** \$1,995.00  
**Manufacturer:** Roland Canada  
**Availability:** Steve's Music

### MPU-401 Processor and Interface

**Description:** An intelligent MIDI processing unit with tape sync and pulse code interfaces. Includes either MIF-IPC or MIF-APL interface card.

**Computer(s):** IBM PC, Apple II and IIe  
**Hard/Software Req:** Appropriate interface cables  
**Price:** \$480.00  
**Manufacturer:** Roland Canada  
**Availability:** XElectronix Computer Music Centre

### MPX820

**Description:** A fully programmable, eight channel mixer, the MPX820 is housed in a 7U EIA rackmountable frame, and can be slaved with up to seven other MPX820s to offer up to sixty-four channels of automated mixdown.

**Hard/Software Req:** Cassette recorder, Compu-Edit software optional.  
**Retail Price:** \$3,295.00  
**Manufacturer:** Akai Audio Video Canada  
**Availability:** Akai

### MSQ-100 MIDI Digital Keyboard Recorder

**Description:** The MSQ-100 can memorize and reproduce in detail all information required for musical performances, such as key velocity, key pressure or bend operation; two loading methods are featured, step and real-time. Tape interface allows date to be stored on cassette.

**Hard/Software Req:** Cassette player  
**Retail Price:** \$995.00  
**Manufacturer:** Roland Canada  
**Availability:** Steve's Music

### MSX Mouse (MU-01)

**Description:** Rodent control for appropriate software.  
**Computer(s):** CX5M or any MSX computer  
**Retail Price:** \$149.00  
**Manufacturer:** Yamaha Canada  
**Availability:** Steve's Music

### MUSE (MIDI Users Sequencer/Editor)

**Description:** A second generation eight track sequencing and editing program with a six thousand note capacity for use with any MIDI equipped instruments.

**Computer(s):** Apple II+ and IIe, Commodore 64  
**Price:** \$225.00  
**Manufacturer:** Roland Canada  
**Availability:** XElectronix Computer Music Centre

### Music Digital Studios 1 and 2

**Description:** Studios 1 and 2 include many features such as sixteen sequences and MIDI channels, eight tracks, track merging, play and record, digital delay, and disk save and load. Soon available for the IBM PC and Atari 520ST.

**Computer(s):** Commodore 64 (MDS 1), Apples (MDS 2)  
**Price:** \$299.00  
**Manufacturer:** Syntech Corporation  
**Availability:** Kaysound

### Music Mate Keyboard

**Description:** Covering two and a half octaves, Music Mate features the ability to play three notes simultaneously, record and play back, eight instrument preset, and the use of a joystick.

**Computer(s):** Commodore 64, 128  
**Price:** \$89.99  
**Manufacturer:** Sequential Circuits  
**Availability:** Commodore

### Music Processing System (MPS)

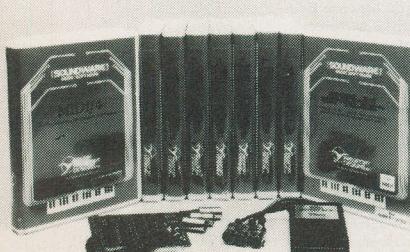
**Description:** A multi-purpose package to drive MIDI instruments from the IBM PC.

**Computer(s):** IBM PCs and compatibles  
**Hard/Software Req:** MPU-401, MIF-IPC, MIDI synthesizer, printer optional.  
**List Price:** \$850.00  
**Manufacturer:** Roland  
**Availability:** XElectronix Computer Music Centre

### Music Studio

**Description:** Featuring pull-down windows for composition and editing, the Music Studio can work with electronic keyboards in stereo to create scores controlling up to sixteen channels. Also included is a library of compositions.

**Computer(s):** Commodore 64/128 and Amiga, Atari 800/XE/XL and ST, IBM PCjr, Tandy



## MIDI Music Survey

**Retail /List Price:** 1000  
**Manufacturer:** Call for price.  
**Availability:** Audio Light

### Music Synthesizer System

**Description:** An internal sound source for the PC, the MSS is a resident card which creates the appearance of up to sixteen independent synthesizers called slots. Slot parameters include MIDI channel, instrument, volume, control keyboard splits and instrument layering.

**Computer(s):** IBM PC, XT, XT and compatibles  
**Hard/Software Req:** One floppy drive, 256K memory, graphics board.  
**Price:** Call for price.  
**Manufacturer:** Tecmar  
**Availability:** XElectronix Computer Music Centre

### MusicWare

**Description:** Four software titles: Song Builder, Song Editor, Song Printer, and Sound Maker.

**Computer(s):** Commodore 64, 128  
**Hard/Software Req:** Music Mate Keyboard  
**Retail Price:** \$9.95 each  
**Manufacturer:** Sequential Circuits  
**Availability:** Commodore

### MX73 Master Keyboard Controller

**Description:** This controller is a full six octave, seventy-three note, velocity sensitive master keyboard with an extensive array of MIDI performance and control parameters.

**Retail Price:** \$1,195.00  
**Manufacturer:** Akai Audio Video Canada  
**Availability:** Akai



### New Digital Orchestra: the NDO Takes Off!

**Description:** An LP of MIDI music with pieces by Greg Stephen, Bruce Mitchell, Dominik Szava and Sue Hunter, and including a track of MIDI data which can be accessed with the CX5M.

**Computer(s):** Yamaha CX5M  
**Hard/Software Req:** Stereo, optional CX5M  
**Price:** \$8.98  
**Manufacturer:** NDO Records  
**Availability:** XElectronix Computer Music Centre

### Omnibus

**Description:** A MIDI librarian which features the ability to file single patches as well as entire groups, to save comments with MIDI dump, to store to auxiliary drives or hard disk, and provides help windows and a search function.

**Computer(s):** Apple II+ and IIE  
**Hard/Software Req:** Any MIDI instrument capable of system exclusive dumps, and a MIDI interface.  
**Retail Price:** \$225.00  
**Manufacturer:** Syntech Corporation  
**Availability:** Kaysound Imports

### Performer

**Description:** A MIDI sequencer, editor and performance tool. This software provides multi-track, real-time and step recording, precise editing and total control of MIDI keyboards.

**Computer(s):** Macintosh 512K  
**Price:** \$399.00  
**Manufacturer:** Mark of the Unicorn  
**Availability:** XElectronix Computer Music Centre

### Personal Composer

**Description:** Integrated software tool for musical composition recording, performance and notation, including word processor functions, and automatic transpose command.

**Computer(s):** IBM PC, XT or compatible  
**Hard/Software Req:** One disk drive, monochrome monitor, printer, Hercules graphics card, Roland MPU-401 and MIF-IPC card.  
**Price:** \$595.00  
**Manufacturer:** Jim Miller  
**Availability:** XElectronix Computer Music Centre

### Pitchrider 4000

**Description:** A pitch recognition device, Pitchrider uses visual and audible display to help improve intonation, and generates MIDI data so that any instrument can drive a MIDI synthesizer or any MIDI software.

**Computer(s):** Apples  
**Hard/Software Req:** Pitchrider Software for Apple (\$125)  
**Price:** \$495.00  
**Manufacturer:** IVL  
**Availability:** XElectronix Computer Music Centre

### Pitchrider 7000

**Description:** A guitar to MIDI interface, Pitchrider allows you to use your guitar to play any MIDI synthesizer.

**Computer(s):** Apples  
**Price:** \$849.00  
**Manufacturer:** IVL  
**Availability:** XElectronix Computer Music Centre

### Polywriter

**Description:** Polywriter software translates musical performances into standard music notation and prints out perfect hardcopy, combining full polyphonic notation with accurate, autocorrected transcription.

**Computer(s):** Apple IIc or IIe  
**Hard/Software Req:** One or two disk drives with controllers; monochrome video monitor; dot matrix printer with graphics; Grappler, Prometheus, Wizard or compatible interface; Soundchaser MX-5 or SC series systems or Passport MIDI interface card and any MIDI-equipped keyboard  
**Price:** \$499.50  
**Manufacturer:** Passport Designs  
**Availability:** B.J. Music

### Polywriter Utilities

**Description:** Polywriter Utilities convert Polywriter and Leadsheet music graphic files into MIDI/4, MIDI/4 plus and MIDI/8 sequencer files.

**Computer(s):** Apple II+ or IIe  
**Hard/Software Req:** One disk drive, any MIDI keyboard, interfaces, dot matrix printer with graphics interface.  
**Price:** \$169.50  
**Manufacturer:** Passport Designs  
**Availability:** XElectronix Computer Music Centre

### Professional Composer

**Description:** A 12 stave music scoring program which allows you to transpose, merge, cut and paste, and then preview an arrangement with the Mac's internal voices.

**Computer(s):** Macintosh  
**Price:** \$825.00  
**Manufacturer:** Smart MIDI, Cherry Lane Technologies  
**Availability:** XElectronix Computer Music Centre

### Remote Keyboards (YK-01 and YK-20)

**Description:** YK-20 is a full-sized keyboard with forty-nine keys which turns your CX5M into a performance synthesizer; model YK-01 is a mini version.

**Computer(s):** CX5M  
**Retail Price:** \$350.00 (YK-20), \$195.00 (YK-01)  
**Manufacturer:** Yamaha Canada  
**Availability:** Steve's Music

### Roland MRC MIDI Recorders

**Description:** An eight track, fully polyphonic recorder which records dynamics, pitch, bend, patch changes, hold, damper and after touch.

**Computer(s):** Apples or IBMs  
**Hard/Software Req:** Computer, monitor, one disk drive, Roland MPU-401 MIDI processor, interfaces, MIDI instrument.  
**Price:** \$200.00  
**Manufacturer:** Roland Canada  
**Availability:** Remenyi House of Music

### RX-21 Digital Rhythm Programmer

**Description:** Programmable drummer with nine drum sounds built in.

**Computer(s):** Any system with MIDI connector  
**Price:** \$360.00  
**Manufacturer:** Yamaha  
**Availability:** XElectronix Computer Music Centre

### S-612 Digital Sampler package

**Description:** This six voice sampler will process any analogue or digital sound and play it back through any MIDI instrument. Included with the Sampler is the MD-280 disk drive.

**Computer(s):** Any MIDI equipped computer.  
**Hard/Software Req:** Synthesizer  
**Retail Price:** \$1,994.00 package  
**Manufacturer:** Akai Audio Video Canada  
**Availability:** Akai

### S900 MIDI Multiple Point Sampler

**Description:** An eight voice, thirty-two point digital sampler, the S900 will digitally record any sound and allow it to be played back polyphonically, and features extensive editing and sound contouring capabilities. A three and a half inch disk drive is built.

**Retail Price:** \$4,295.00  
**Manufacturer:** Akai Audio Video Canada  
**Availability:** Akai

### SBX-10 Sync Box/Converter

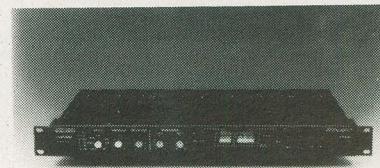
**Description:** Accepting either MIDI, DIN-Sync or Time Base signals, the SBX-10 simultaneously synchronizes all connected devices, and allows user to freely program the tempo of the music.

**Price:** \$675.00  
**Manufacturer:** Roland Canada  
**Availability:** Steve's Music

### SDE-2500 Digital Delay Line

**Description:** Storing sixty-four kinds of programmable memories which can be recalled by the MIDI program change information, the SDE-2500 can be used with any MIDI instrument on the market; any kind of desired effect can be accurately produced, including flanging, chorus, doubling and echo.

**Price:** \$765.00  
**Manufacturer:** Roland Canada  
**Availability:** XElectronix Computer Music Centre



### Sequence Compiler

**Description:** Working in CP/M, the Sequence Compiler will work with most word processors, such as WordStar.

**Computer(s):** Apples  
**Retail Price:** \$99.99  
**Manufacturer:** The MIDI Connection  
**Availability:** The MIDI Connection

### SFG-05

**Description:** An FM tone generator that plugs into the CX5M computer, the SFG-05 can be used with the Yamaha YK-01, YK-10 or MIDI music keyboards, and can store to disk, cassette or UDC-01 cartridge.

**Computer(s):** CX5M  
**Hard/Software Req:** Disk drive or cassette recorder, MSX or Epson printer optional.  
**Price:** \$250.00  
**Manufacturer:** Yamaha Canada  
**Availability:** XElectronix Computer Music Centre

### Soundwave Music Recorder

**Description:** Turning the computer into a professional multitrack music recorder playing up to sixteen synthesizers or drum machines, the SW-24 features real and step time recording, rhythmic autocorrect and autoclocate.

**Computer(s):** Atari ST 520 and 1040  
**Retail Price:** \$299.00  
**Manufacturer:** Soundwave Software  
**Availability:** Soundwave Software

### StudioMac Synthesizer Kit

**Description:** A music expansion kit for the Macintosh, this includes Casio CZ-101 Synthesizer, StudioMac Software, and MIDI Adapter.

**Computer(s):** Macintosh  
**Retail Price:** \$595.00US, \$125.00US for software alone.  
**Manufacturer:** Creative Solutions  
**Availability:** Creative Solutions

### Synthestra

**Description:** A MIDI sequencer and controller program which can control up to sixteen MIDI instruments devices from one keyboard.

**Computer(s):** Apple II+ and IIE  
**Hard/Software Req:** MIDI interface, at least one MIDI equipped keyboard.  
**Retail Price:** \$120.00 US  
**Manufacturer:** Decillionix  
**Availability:** Decillionix

## MIDI Music Survey

### Tape 'N Step

**Description:** Allowing real-time and step recording, this program has capability for nested loops and pattern calls, and can be used on a hard disk system.

**Computer(s):** IBM PC and compatibles

**Hard/Software Req:** MPU-401 Roland interface, any MIDI synthesizer.

**List Price:** \$150.00

**Manufacturer:** Non-Zero Communication

**Availability:** Roland Canada

### Texture

**Description:** "Modular Recording" allows flexible editing and manipulation of musical material; compositions may be recorded as small "patterns" and linked together to form a whole song; up to eight tracks of polyphonic MIDI data can be recorded and played back.

**Computer(s):** IBM PC

**Hard/Software Req:** 128K memory, one disk drive, video monitor

**Price:** \$295.00

**Manufacturer:** Roger Powell

**Availability:** XLelectronix Computer Music Centre

### Total Music

**Description:** Capable of MIDI sequencing, interactive editing and transposition, Total Music can record and playback up to 128 simultaneous tracks, using all sixteen MIDI channels.

**Computer(s):** Macintosh

**Hard/Software Req:** Mouse

**Price:** \$649.00

**Manufacturer:** Southworth Music Systems

**Availability:** XLelectronix Computer Music Centre

### TR-727 Rhythm Composer

**Description:** With fifteen different, digitally recorded Latin percussion sounds, the TR-727 can be a programmable percussion machine, or a percussion sound source for a MIDI sending unit.

**Price:** \$975.00

**Manufacturer:** Roland Canada

**Availability:** Steve's Music

### Yamaha DX-PRO

**Description:** Provides easy programming of Yamaha DX-7 synthesizer modules, allowing the saving, organization and retrieval of DX voices; includes nearly 300 voices on disk library.

**Computer(s):** Apple II+, IIe

**Hard/Software Req:** Computer, one disk drive, monitor, interfaces, synthesizer.

**Price:** \$325.00

**Manufacturer:** Yamaha Canada

**Availability:** Remenyi House of Music

### Yamaha PN-101

**Description:** Compact dot matrix printer, 40 characters per second.

printer, 40 characters

per second.

**Computer(s):** CX5M, or any MSX computer

**Hard/Software Req:** CB-01 printer cable

**Price:** \$450.00

**Manufacturer:** Yamaha Canada

**Availability:** Steve's Music

### YRM-301 MIDI Recorder Cartridge

**Description:** The YRM-301 allows real-time four track digital recording from any MIDI keyboard, note by note step-write recording, editing, and full mix-down capabilities, and is compatible with the Yamaha Mouse. Versatile file handling permits storage to either disk or cassette.

**Computer(s):** CX5M

**Price:** \$69.95

**Manufacturer:** Yamaha Canada

**Availability:** XLelectronix Computer Music Centre

### Music Survey Sources:

- Activision Home Computer Software, 2350 Bayshore Frontage Road, Mountain View, California 94043, (415) 960-0410 ● AKAI Audio Video Canada, 121 Watline Avenue, Mississauga, Ontario L4Z 1P2, (416) 890-2300 ● Alchemy Mindworks, P.O. Box 313, Markham, Ontario L3P 3J8 ● B.J. Music, Division of Hornberger Music, 469 King Street West, Toronto, Ontario M5V 1K4, (416) 596-8361 ● Commodore Business Machines, 3370 Pharmacy Avenue, Agincourt, Ontario M1W 2K4, (416) 499-4292 ● Creative Solutions, 4701 Randolph Road, Suite 12, Rockville, Maryland 20852, (301) 984-0262 ● Decillionix, P.O. Box 70985, Sunnyvale, California 94086, (408) 732-7758 ● Deep Magic Music, 1742 Second Avenue, Suite 220, New York, New York 10128, (212) 534-0728 ● Dr. T's Music Software, 66 Louise Road, Chestnut Hill, Massachusetts 02167, (617) 244-6954 ● Drumpulse, 3921 Island Home Pike, Knoxville, Tennessee 37920, (615) 573-9787 ● E-mu Systems, Inc., 1600 Green Hills Road, Scotts Valley, California 95066, (408) 438-1921 ● Kaysound Imports, 6969 Trans Canada Highway, Suite 123, St. Laurent, Quebec H4T 1V8, (514) 331-8420 ● The MIDI Connection, Programme Plus, P.O.Box 282, Station D, Montreal, Quebec H3K 3G5, (514) 933-5127 ● Remenyi House of Music, 210 Bloor Street West, Toronto, Ontario M5S 1T8, (416) 961-3311 ● Roland Canada, 1515 Matheson Boulevard, Units B11 and B12, Mississauga, Ontario L4W 2P5, (416) 625-4880 ● Soundwave Software, 378 Isabey, St. Laurent, Quebec H4T 1W1, (514) 738-3000 ● Steve's Music, 415 Queen Street West, Toronto, Ontario M5V 2A5, (416) 593-8888 ● Waterloo Music, 1335 Carling Avenue, Ottawa, Ontario K1Z 8N8, (613) 728-2084 ● XLelectronix Computer Music Centre, 317 College Street, Toronto, Ontario M5T 1S2, (416) 921-8941 ● Yamaha Canada Music, 135 Milner Avenue, Scarborough, Ontario M1S 3R1, (416) 298-1311

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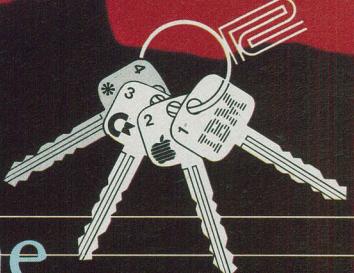
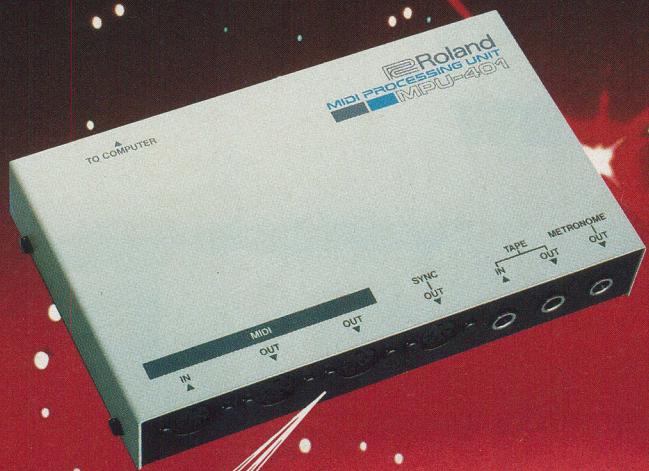
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# The Akai S612 MIDI Digital Sampler Review



There have been numerous attempts to create real pianos that can play under computer control. This box can actually make it happen. It can also create MIDI violins, MIDI car horns, MIDI waterfalls, MIDI alley cats... in fact, if you can hear it the sampler can capture it and turn it into a voice.

by Steve Rimmer

**D**espite the increasing sophistication of microcomputer based synthesizers, there's still nothing like authentic natural sounds to give one's electronically generated music an aura of

authenticity. Wooden and brass instruments still sound just a bit more real than their virtual imitators. Birds can't really be duplicated with a sample and hold... although many have tried. Special effects

like cars starting, guns going off or cabinet ministers lying through their teeth are all things that really should be used as they really happen if they're to seem genuine.

There's only so much you can do with

## Akai Sampler

even the most powerful patch and voice editing programs.

The Akai S612 MIDI Digital Sampler is possibly one of the most powerful MIDI voice sources in creation. Its synthesis capabilities are practically non-existent, it can't really be patched, programmed or dumped, but what it lacks in complicated specifications it makes up for in potential. The Akai sampler can capture real acoustic noises in all their complexity, digitize them... stashing them on floppy disks if you want to save them for later on... and ultimately allow one to play them though a MIDI keyboard.

What's more, you don't need a degree in audio engineering to make it work.

### Sample Case

The sampler is a rack mounted black box with a surprising lack of knobs and buttons. There are a few controls on it... mostly to designate how things get recorded... but its essentially simple function doesn't really demand a lot of paraphernalia. It takes longer to unpack than it does to master.

The sampler can accept sounds to sample from virtually any source. It has both line level and microphone inputs. If you plug a mike into it you can have it check out almost anything you can hear. Alternately,

the line level input allows one to collect noises with a tape recorder... presumably out where one does not want to drag one's sampler... and then play them into the box after the fact.

In sampling a sound, there are several things to consider. The sampler behaves a bit like a tape recorder with a very short tape. The amount of time available to store sounds in the sampler varies with the frequency response one wants to have in the recording. A four kilohertz bandwidth allows one eight seconds of sampling time. A thirty-two kilohertz bandwidth... arguably a bit pointless, as even dogs can't hear things up this high... lets the sampler run for one second. This represents a pretty generous helping of memory in there.

Because the sounds in the sampler must be controlled through its MIDI interface, the sampler assumes that it will have a MIDI keyboard attached to it. Thus, the bandwidth is set by hitting a key between C2 and C5, where the higher notes represent wider bandwidths and correspondingly shorter samples.

The next consideration in sampling something is in providing the sampler with a trigger. If one thinks of it as a tape recorder, it has to know when to hit its start button. Now, one can trigger the sampler

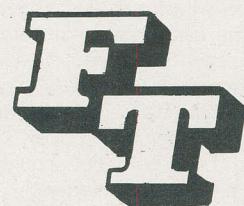
manually... you'd need an optional foot pedal... or electronically from some other trigger source, but these tend to be impractical trigger sources for most of the things that one tries to sample. The most useful approach, and the one that the sampler has built into itself, is a fairly sophisticated trigger circuit which derives a trigger from the attack of the sound one is sampling.

In practice, then, one can usually ignore considerations of triggering for the sampler, and just heave noises at it.

The sounds that the sampler emits from its digital representations of the world around it can be easily as authentic sounding as if they'd been taped. It has enormous fidelity, and a fast enough sampling rate to effectively eliminate digital crunching of one's noises.

Having stored a sound in the sampler one can send some MIDI data to it and the sound will play back at the pitch of the notes... not necessarily the pitch at which it was recorded. As such, for example, one could sample a single C on a violin and then play a whole piece of music with that note, its pitch varying to suit the MIDI data.

This has a lot of conceptual hangups, of course. True purists will note immediately that the timbre, or harmonic content, of a violin note isn't constant across its range,



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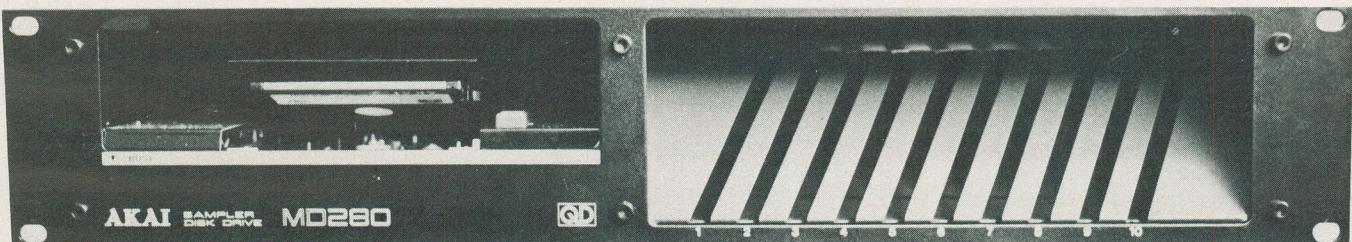
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## Akai Sampler



and that a note played an octave below what it was recorded at won't sound exactly like a real violin playing the lower note. This is true, and the sampler doesn't really have much to say about it.

True purists are, however, very often just being pains in the buns because they have better stereos than anyone else. As such, we'll ignore this consideration for the moment. It's a trivial point in most applications.

In playing a sample back at a pitch other than that at which it was recorded, the sampler is effectively sending its individual digital samples out through its audio line at a speed other than that at which they were created. As such, the pitch of a sampled note will change. However, the duration of the note will also vary... higher pitches will cause the sampler to cruise through its entire set of samples in a shorter time.

This effect doesn't really matter if you're sampling a more or less steady tone, such as a single note from a violin, but it can avail one of some fairly strange effects... or weird problems... if one is dealing with complex sounds.

In the spirit of experimentation and because he was chewing on the cat, I decided to see if the sampler could call our dog. Our dog is a ninety pound Irish setter with almost no brains, and, as such, is dangerous when confused. Saying "Come, Winston" into the sequencer and hitting the same MIDI key as I had previously stabbed to set the sampling rate produced a sufficiently lifelike reproduction of my voice to convince the dog that he was wanted.

The dog, being either very loyal or very empty headed, won't come for anyone he doesn't recognize.

Hitting a key half an octave up the keyboard produced a sped up, munchkin version of my voice, which the dog ignored. Both the apparent pitch and the duration of the phrase were affected. Playing the same phrase half an octave down also confused the dog, as he thought he was being growled at.

Aside from sampling sounds, the sampler also allows one to overdub multiple samples. This allows one to, for example, create complex noises out of simple ones by layering them. Saying "oooh" into the thing five or six times produces a pretty decent Gregorian chant sound.

Overdubbing "come, Winston" and "sit, Winston" produced an almost unintelligible noise which, none the less, made the dog come over and sit down. Dogs are very peculiar creatures.

Further experiments on the family animals revealed that a cat's meow as it is being chewed by a large red dog, when



dropped by an octave, sounds like a drunk lion. Cats seem to be particularly frightened by the sound of lions.

### Underdubs

There are a number of basic sonic manipulations that the sampler will allow one to perform on the samples it's holding. The overdubbing facility is among the most potentially useful, but it's far from the most entertaining.

One can think of there being two pointers into the memory in which samples are held, one each for the beginning and the end of the part that will be played back.

There are two conceptually slick faders on the front panel of the box to allow one to vary these pointers. If the faders are at the beginning and end of their travels respectively, one hears the sound exactly as it was sampled.

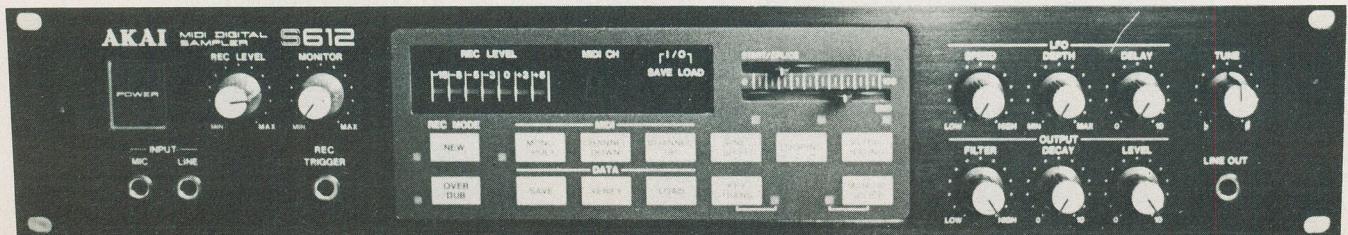
If one moves the faders, one can elect to hear any part of a sampled sound. Moving the faders around with my dog call in memory allowed me, for example, to isolate the dog's name. More useful applications would allow one to play just a part of a note, perhaps lopping off the attack and just playing the decay.

One wonders, of course, what might happen if the fader which represents the end of the sound were to be set before the one that represents the beginning. As it happens, the sound plays backwards. This is a really fascinating effect, as one winds up with sounds of a sort that rarely occur in nature. However, one of the things one notices in playing with this is that in recording a sound one usually sets the sample rate a bit too low, such that there is silence at the end of the sample. If the note is played backwards, there can be a noticeable pause between the time one hits a key and anything happens because of this. You can, of course, chop it off with the faders.

The sampler includes a low frequency oscillator to add vibrato to the sounds it produces. The speed at which the samples of a sound are stepped out of the sampler is set by a clock. The speed of the clock can be made to swing a bit by setting up the low frequency oscillator, resulting in the sounds appearing to vary a bit in pitch. It's a grossly over used effect, of course, but you can turn it off if you don't want to use it.

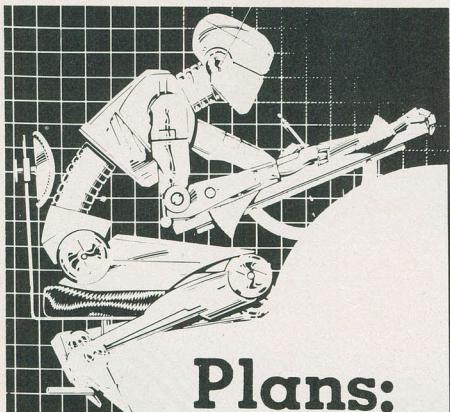
There's a low pass filter built into the system. It's occasionally useful, but I found that I left it turned all the way up most of the time. One can also affect the decay time of the sounds coming out of the box. This is pretty interesting... things that ordinary have sharp decays sound pretty weird if you crank this knob up.

Finally, you can adjust the overall pitch



## Akai Sampler

of the sounds to tune the sampler to other instruments. There's a key transposition button to let it jump around in large increments, and a fine tuning knob which swings a hundred cents... a full semitone... in either direction.



### Plans:

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#### Hardware

The sampler has a pretty standard MIDI interface, with a few exceptions. It can only handle data coming in on channels one through nine... because there is only one digit in its channel number display. This is a bit funky, methinks. However, it also has an omni mode, which is what it likes to default to when it's powered up. In this mode it will play any MIDI note data on any channel that's fed to it... this is a bit weird if you forget to turn it off. The sampler doesn't have battery backed up memory to preserve its settings through powering down. This is something that a lot of MIDI instrument builders do seem to be incorporating into their boxes... a good thing if you're into a lot of boxes and don't want to have to set them all up every time you want to play.

Likewise, there doesn't seem to be any way to set the sampler's parameters remotely from a computer.

The sampler will play a single voice in six note polyphony, that is, you can play six notes in one voice at a time. There's a jack out back to allow one to access the six notes individually... I can't say why this should be useful, but it's harmless.

Having created a sampled voice, the sampler allows one to save it to something more permanent. The choices of permanence are a Commodore type cassette recorder or the Akai dedicated disk drive.

The cassette recorder is a bit of a cow... it's cheap, but tape accesses take about two minutes each. The disk drive, on the other hand, is fast, quite convenient and only a bit weird.

The disk drive uses special two and bit inch disks that aren't seen anywhere else west of Japan. This in itself is a bit scary, as Akai seems to be the only source for these things. Each disk holds a single sampled voice to a side... the disks are double sided. The system saves and loads to its drive in a couple of seconds. The drive itself is a second rack mounted box that takes up the same amount of panel space as does the sampler itself. In fact, the drive only occupies half of the panel... at a loss for something meaningful to do with the other half, the system's designers put in a slab of metal with slots in it to stash one's floppy disks in.

Again, there doesn't seem to be any way to have the system dump its samples over the MIDI interface to a computer. This is a shame, as in many cases saving sampled sounds and sending them to the sampler under computer control would be preferable to wildly popping disks in and out of the little drive.

### Amazing Grass

The sampler is unquestionably one of the really unique MIDI sound sources on the planet just now. It's difficult to explain why it sounds so much more interesting than do purely synthetic voices... naturally occurring noises, whether they spew out of instruments or just happen in fields or garages, are extremely complex and interesting, much more so than wholly electronic ones.

The potential of the sampler to combine the power of MIDI performance and the richness of natural sounds is alluring. The inherent simplicity of its operation, and its generally well thought out functions, make it a painless way to have these sounds in one's tunes. Well, "painless" is a relative term... you may find that it brings upon you a curse of wallet munchers, but that's an almost essential part of any technology more complicated than a pencil.

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# The NAMM Show Report

The National Association of Music Merchants show is a periodic feast of new music toys, MIDI based and otherwise. The author chronicles his journey.

by Greg Stephen

Our last visit to the National Association of Music Merchants trade show took us to New Orleans where we were able to savour the delights of the French Quarter along with all the new musical treats packed inside the Rivergate Expo. These shows take some getting used to given the hawkish atmosphere, bright lights, and incessant din like hundreds of forgotten pop songs playing simultaneously at full volume and half speed.

The most recent extravaganza, or winter NAMM, was held in Anaheim California, in a large building directly across the street from Disneyland West. The first thing one felt about this year's show was the amazing similarity between eighty-nine degrees fahrenheit in New Orleans and eighty-nine degrees fahrenheit in Anaheim. Leaving Toronto in mid January in both cases gave us the same thawing out sensation together with a slight dizziness like a hibernating animal plucked from its lair in mid sleep.

You could tell the Canadians down for the music show, as they all resembled KGB agents grimly observing the California dream, knowing they'd be recalled to the North soon enough. And if that doesn't dampen the spirits of the stanchest Maple Leafers, there's always the financial side of the coin, the incessant calculations adding almost fifty percent to the price of everything on display and the knowledge that most of the new supplies won't reach the post at Hudson's Bay until well after the spring runoff.

## The Hills Are Alive

Nonetheless, Canadians, being a hearty and optimistic lot, had much to celebrate this year. There was, for example, Nexus Computer Consultants from Toronto, showing their FM Drawing Board, a computer based voice editing system for Yamaha's DX7 synthesizer. This genre of utility for the DX7 has become the word processor of the music business with almost as many titles now as its computer counterpart. There are just over a hundred thousand

DX7s oscillating world wide and while there aren't quite that many companies offering voice editors, there are enough that the difficulty in editing manually has been replaced with the difficulty of applying the truth in advertising act. That being the case, I think if I were going to order a DX editor sight unseen, I'd order it from Nexus.

There's something inherently honest about the Nexus package. It arrives in a sturdy library type box capable of surviving the fallout from a back to work order at Canada Post. Its subdued grey toning suggests a mature, spartan attitude well suited to the utilitarian task. Nexus lists versions of FM Drawing Board for the IBM PC and Amiga but we were only able to test drive the Apple. The software achieves that much coveted state of confidence where the user can tootle around sans manual and not feel they've just jumped through the bomb bay without a parachute.

Unfortunately, concentrating on FM software in the middle of the Anaheim Convention Center is a bit like reciting Wordsworth at a Hallowe'en party. The Nexus package deserves a closer look under saner circumstances.

Diagonally across from Nexus we saw a herd of people vying in a semicircle for a better view. At the centre of this arc of humanity was Jim Miller, the author of Personal Composer. Jim Miller's sequencer scoring package for the IBM PC is a real success story in music software and rightly so. Miller himself is a picture of vibrant health... I'm certain he writes code atop his surfboard in Hawaii. I'm less certain about the meaning of the plans Jim was describing for Personal Composer updates. Apparently everything's headed for artificial intelligence, and Jim Miller couldn't be happier.

Continuing on past rows of guitars, drums and lighting we came upon Cherry Lane, who were sharing floor space with Canadian based IVL Technologies. David Archambault of Cherry

## The NAMM Show Report

Lane was on hand as well as what looked like the body of Roger Powell, we weren't sure because his head was buried most of the time inside the case of an unco-operative IBM.

Things aren't too cheery at Cherry Lane. Their product line, though small, shows an astute understanding of the marketplace and they haven't hesitated to commit themselves to financing developments for newcomers like the Amiga. The difficulty, as Archambault outlined it, was dealer awareness. Roger Powell's Texture for example, was a rousing success as a sequencer for the PC among the initiated, but at the order desk of Cactus Music in Arizona it was just number fourteen on a list of twenty. As a result, many shops were simply waiting for a customer's order before they'd call a supplier at all.

The unfortunate upshot of all this is that Cherry Lane have announced they're calling it quits and leaving music software to the stouter of hearts. Roger Powell will continue to work under his own auspices but the future of those projects Archambault had under development is far less certain.

This was in direct contrast to the other half of the exhibit, where the IVL people were smiling like cats who had caught a lot of mice. All that was needed was a backdrop of the flag and Oh Canada playing in the distance to complete the political convention razz ma tazz that had infected their display. It was not without reason, for the cause celebre was the Pitchrider guitar to MIDI Interface, a device which has captured the hearts and imagination of Americans from Baton Rouge to Seattle.

Unlike its predecessor, the new guitar interface allows polyphonic output, even separate MIDI channels for each guitar string. As it turned out, IVL, realizing this was one tiger whose tail they couldn't handle alone, had signed an arrangement with Kramer, the guitar giant from New Jersey, to handle the American marketing and distribution. The agreement was rumoured to be in excess of one million dollars for the Victoria based IVL. All the manufacturing continues in Canada, although the product will bear the Kramer logo. Pitchriders were piled to the rafters at the Kramer booth almost touching the bottom of their huge banner, which read "Proud to be an American Company."

Finally, near the end of our journey, we came across a small display from Tecmar International. They were showing, for the first time, their long awaited music synthesizer system. The specifications alone are quite impressive, with sixteen independent polyphonic synthesizers, MIDI compatibility using Roland's MPU-401, user sampling at fifty kilohertz, and a sixty-five thousand note sequencer. All of this lives on a single card for the IBM PC. The software, which wasn't fully implemented in the version we saw, provided user defined page mapped wave memory, a nice change from the omnipresent algorithms of FM, and graphic display of volume, pitch, and harmonic envelopes, also user defined. The hardware is currently undergoing beta testing and, consistent with Tecmar's reputation for reliability, should emerge as a real heavyweight in the sound module playoffs.

### Future Engagements

In addition to these items there were the usual new alphabet soup model numbers going down at Yamaha and Roland, while Akai continued to demonstrate their tenacity in competing with the best of them. In the international corporate chess tournament we saw Yamaha manoeuvre into a controlling interest in Korg, although the results may not become apparent for some time, and on a rather long list of the conspicuously absent from the exhibitors roster were the likes of Sequential Circuits and Southworth Music.

There were a lot of cards being held close to the chest at the Anaheim show and lots of talk behind closed doors. My guess is that things will simmer a bit for the next little while, and then we'll see a massive offensive when the whole shooting match blows in to Chicago this June.

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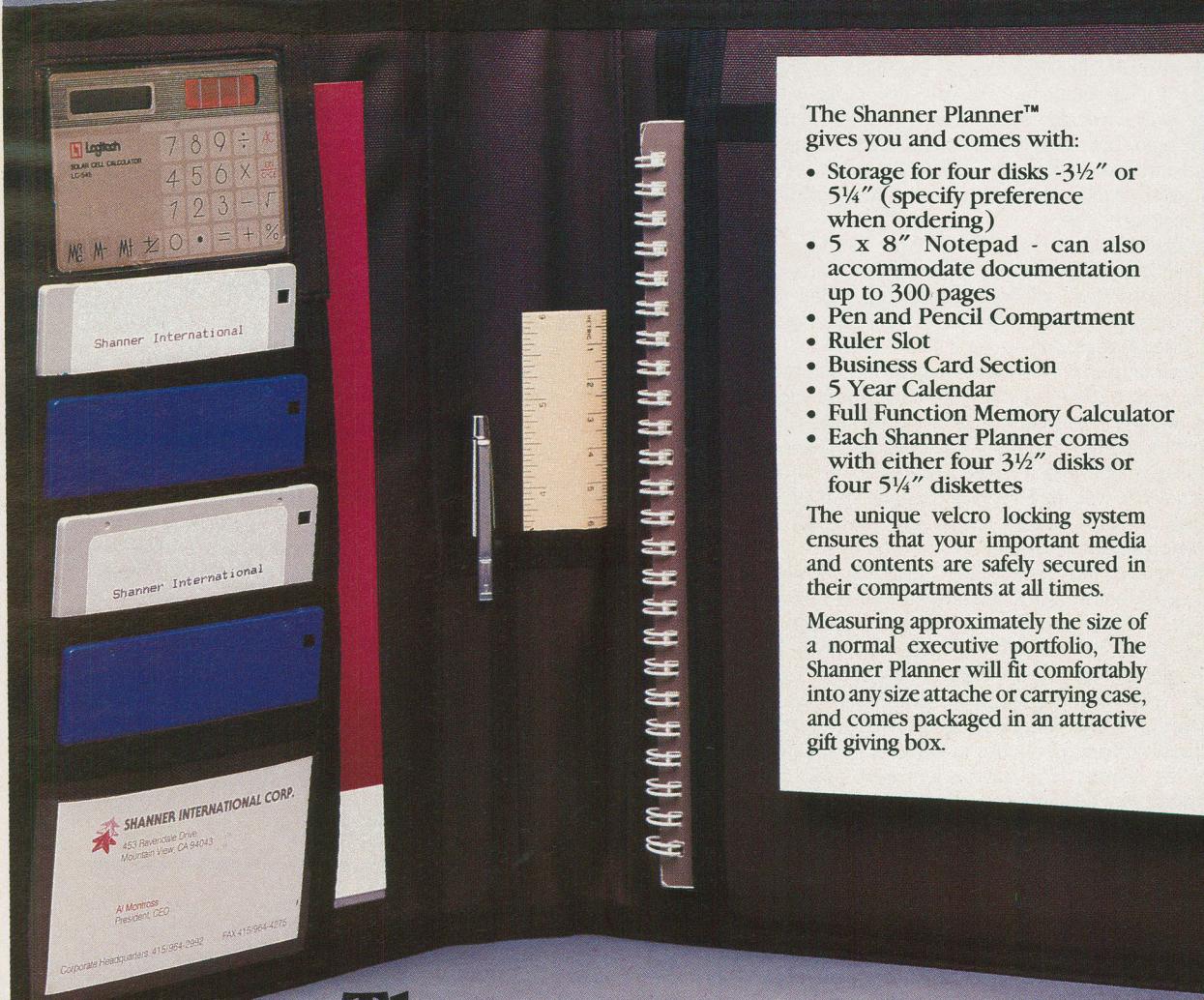
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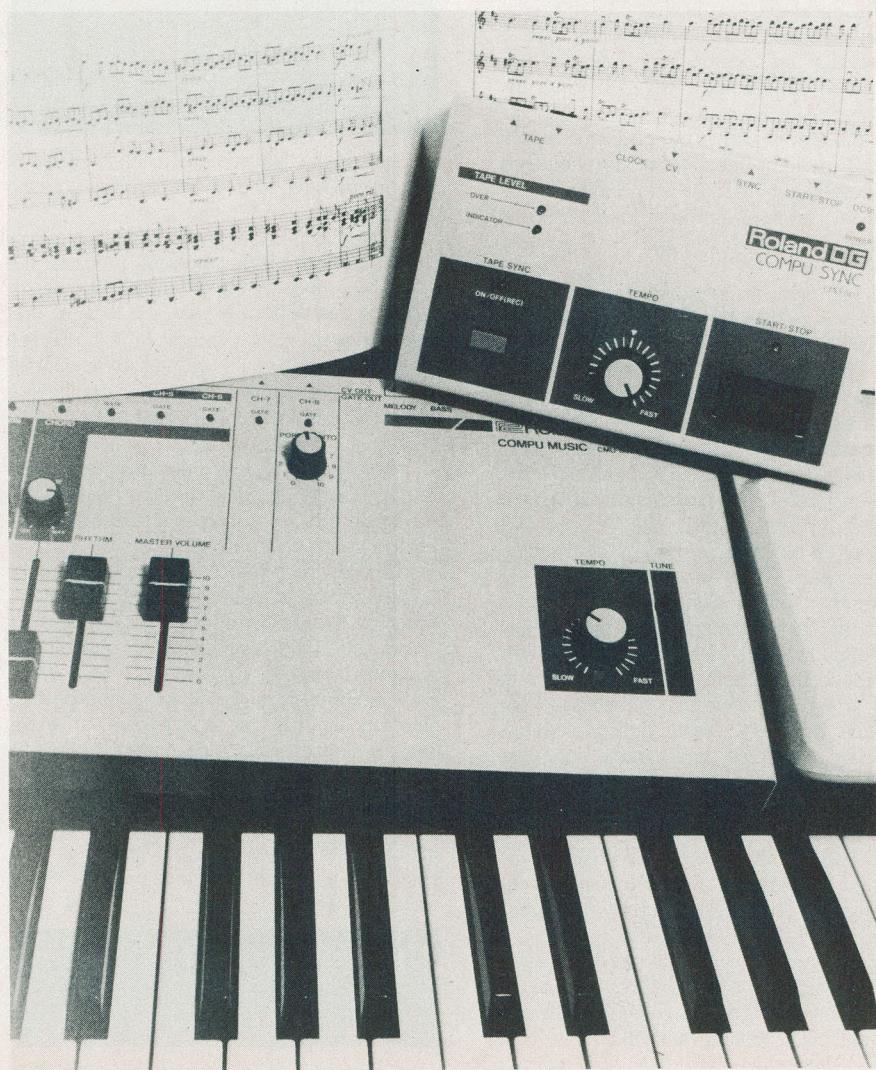
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# Basic Score Notation

If you're just getting into computer music and are even now staring at a score editing program for the first time you might find things a bit easier if you check out this painless introduction to the weird squiggles and cat scratches involved therein.

by S. R. Ferrybridge



**S**ight reading is one of those things that you really have to want to do... and not all that many people really want to. There are a lot of things you have to keep juggling around in your head when you're looking at a score. This is true of both hopelessly antiquated paper scores and really high tech computer based score editor screens for MIDI music.

If you boot up a score editor like Personal Composer for the first time you'll probably be confronted with a lot of sheet music notation all at once. Bearing in mind that the foundation for this stuff was laid about three or four hundred years ago... when people had a lot more time than they do now... you may not be able to get your head into the elegant obscurity of it all really quickly.

Sadly, one must have a reasonable grounding in this stuff before one can do much with all these toys.

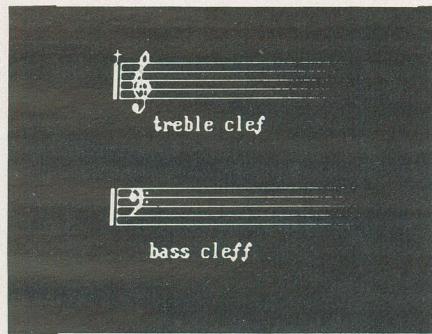
In this article we're going to have a shot at some basic score theory. I'm not going boogie into anything really intense and we'll try to avoid the stuff that only orchestra conductors would have any use for. The rest of it's pretty simple, actually, and can be expressed in computer terms without bending anything too terribly much.

## Clef Hanging

Music is written on staves... the singular of which is *staff*. A staff is five horizontal lines. You probably already knew this.

The first thing one normally encounters on a staff is a clef. There are a number of clefs one might encounter in music, but the only two that we're going to worry about are the treble clef and the bass clef, shown here.

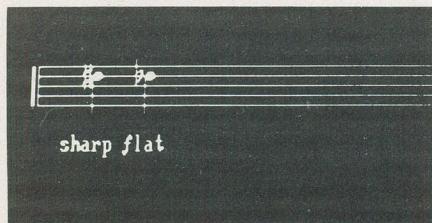
## Basic Score Notation



These guys determine what the notes following them mean. For example, a note placed on the lowest line of the staff is an E following a treble clef or a G following a bass clef. The G in this case is quite a bit lower in pitch.

Notes can turn up on a line or between two lines. The interval between a note on a staff and the next possible position for one above or below it is called a *tone*. The notes are designated by the letters A through G. The note above G is the next higher A. The range from one note to the next note of the same letter is called an *octave*, as there are eight tones between 'em. In electrical terms, if you double the pitch of a note you raise it by one octave.

Aside from changing the pitch of a note by a full tone, we can move it by a half a tone, or a *semitone*. A note which is a semitone lower than it would normally be is said to be *flat*. One which is a semitone higher is said to be *sharp*. These are the symbols used for flats and sharps.



We'll get a bit further into these guys in a moment.

Notes themselves are plopped down on a staff as dots. The exact appearance of the dot tells us how long the note is intended to stay on for. The longest note is a whole note, and is represented as a dot with the centre drilled out. The shortest commonly encountered note is a thirty-second note, although they get shorter still. This is represented as a black dot with a stem sticking out of it and three flags flying from the stem.

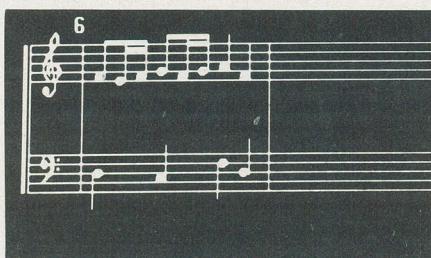
This is the full range of notes.



You'll find notes with the stems sticking up or down. There isn't any inherent reason why they're one way or the other... it's done more for appearance sake. However, some scoring programs allow you to use this otherwise meaningless variation by assigning the notes with their stems up to one MIDI channel and those with their stems down to a second channel if you want to.

Given a piece of music played at a normal speed, a whole note will sound like a long drone, while thirty-second notes will clip by faster than one would imagine one could manually play them.

In most moderately complex music, one sees staves with the bass and treble clefs joined, like this:



This indicates that both staves are to be played together. That is, at the same time as one hits the first note on the upper staff one would also hit the note beneath it on the lower staff.

If the staves weren't joined, one would play the whole upper staff through and then the whole lower one... it would sound a bit weird, in this case, as the second bit of the music would suddenly drop a couple of octaves.

If you listen to a piece of music you'll probably note that it's fairly easy to hear the melody line, but that the bass notes are much more difficult to identify. As a general... and often broken... rule, the bass clef carries the rhythm while the treble clef takes care of the actual tune.

This is the full range of notes over the treble and bass clefs. Notice that when one runs out of room above or below a clef one can draw in extra lines and lay down some notes anyway. These are called *ledger lines*.

Another useful thing to know about clefs is that more complex music is allowed to have multiple staves with the same clef on more than one of them. This is often seen in music which was written for stringed instruments, such as fiddles... violins to the upper crust. Fiddles are more or less monophonic, that is, only able to get out one note at a time. If one wanted to have three notes of a violin piece played at once... what they properly call a *chord*... one had to hire three fiddle players. As such, one wrote down three staves, one each for what would be played by the three fiddlers.

In using MIDI we still do this, even though most MIDI instruments are polyphonic. This allows us to have each part of a piece played by a different voice.

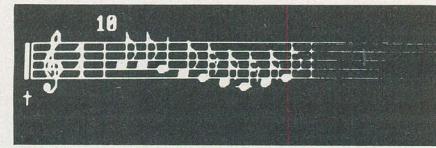
There are two things that do in most people who set out to try to understand music notation. The first is timing and the second is keys. We're going to leave keys for a while and get into the former topic, which isn't as weird as it sounds if you don't mind skipping over a few of the less pertinent details.

This is a treble clef followed by one measure of music. You'll also note that there is a fraction on the staff. This denotes that the music is to be played in four four time, or what is called *common* time. Let's not worry about what this means just now.



You will notice that there are eight notes on this staff, and that they are all eighth notes. The aggregate note value, then, adds up to one. Ah hah.

Here's another bit of music. It's a tad more complex.



Its notes also add up to one, although you might have to do a bit of tricky figuring to see how.

The top number in the fraction tells us what portion of the bottom number the notes in a measure should add up to, allowing that the bottom is one. To look at that another way, if the fraction here had been  $\frac{1}{2}$ , we would have wanted two quarter notes per measure, rather than four, or a collection of smaller notes that added up to this.

Much of the music one runs into is written in common time. Just make sure that all the notes add up and time signatures won't be too much of a hassle.

There are few other considerations of timing to be concerned with. The most notable of these involves the use of rests.

It's often the case that one wants to have a pause in music. Occasionally in a score with multiple parts you'll want one part to shut up for part of a measure or even several measures. This is what one uses rests for.

Rests, like notes, run from whole rests to thirty-second rests and beyond. In adding up the note values in a bar of music you should also add in the values of any rests. These are rests:

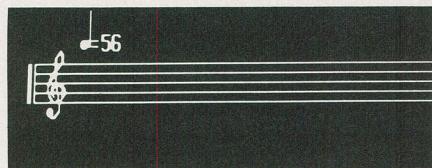


## Basic Score Notation

One occasionally sees notes that are followed by one or two dots. There's always the possibility that these are just ink spots, but, assuming that they aren't they indicate that the note is to be played for a bit longer. Adding a dot to a quarter note means that it should be played for a quarter note and an eighth note longer. Adding two dots means that it should be played for a quarter and an eighth and a sixteenth. Dotted notes are often used to let an otherwise stiff and regular bit of music "breath" a bit.

Now, all this talk of the length of notes will probably cause one to ask about the timing of all this. We know that a quarter note is played for a quarter of the time that whole note is played for... unless it's dotted or there's an R in the month... but the question still remains as to how long that whole note is supposed to be played for. Students of nihilistic philosophy will tell you that it's played for four times the length of a quarter note that's played for a quarter of its length and leave it at that.

In fact, the absolute timing of a piece of music is a bit flexible. Some music is given a fixed number of beats per minute, as in



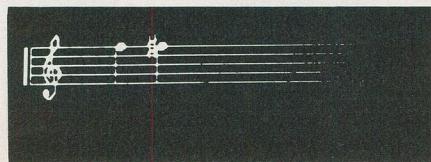
but you're pretty free to play it as fast or as slowly as you want to, providing you maintain the relative lengths of the notes and rests.

### The Key To It

Keys are one of the great nasties of score notation when you first get into them. So far we have actually been looking at music which is written in the key of C. However, music can be written in any key. The key is indicated by the sharps and flats that live at the beginning of a staff. Unfortunately, there is no immediately obvious correlation between the number and position of the flats or sharps and the key signature. Table one lists the possible keys and how the sharps and flats line up.

I may be getting ahead of myself here. Hold on for a second.

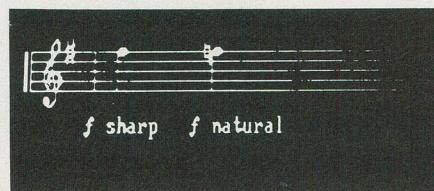
If you place a sharp symbol before a note, the note is to be played one semitone higher than it would have been normally. Assuming that one is writing in the key of C, in which all the notes sound as they appear on the staff, one might find that one wants a particular F to actually be F3. One would



It is very often the case, however, that one writes in another key, such that in a normal scale all the Fs are sharpened. This is, in fact, the key of G. We could get away with simply slapping a sharp on every F we write, but it's proper to indicate that all the Fs will be sharpened by putting a sharp at the beginning of the staff.

When you indicate that the music on a staff is to be played in the key of D, that is, with all the Fs sharpened, you are specifying not only the Fs that turn up on the highest staff line, but also any other Fs. For example, the note just above the bottom line of the staff is also F, and is also sharpened.

Occasionally one will be playing in a key, such as the key of D, and will want to play an unsharpened note which would otherwise be sharpened because of the key it's being played in. In this case, we might want an F while the key wants us to play only F3s. The symbol for this is the *natural*



which serves as a one shot cancellation for an otherwise sharpened or flattened note, just as a sharp or flat can serve as a one shot modifier.

If you take a tune which was written in one key, say the key of C, and move all the notes up the staff by the same interval, say so that it winds up in the key of G, the tune will still sound the same... although it will be a bit higher in pitch. This is called transposition. MIDI score editors like Personal Composer usually have automatic transposition which will handle adjusting the key.

### Adagio

There is, obviously, a lot more to all the arcane scribbling of sheet music than this... there are all sorts of good books on the subject. You can find them in any library under dust.

In fact, armed with these rudiments of score notation you should be able to belly up to your computer and look your scoring software in the eye... if you can find it. These basic bits are most of what one encounters in sheet music. They're certainly enough to allow you to transcribe existing works, and probably enough to get you into writing some of our own.

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Table one shows the sharps and flats for each key signature. The columns represent the number of sharps (0 to 7) and the rows represent the number of flats (0 to 7). The keys are listed as follows:

|         | 0 Sharp | 1 Sharp | 2 Sharp | 3 Sharp | 4 Sharp | 5 Sharp | 6 Sharp | 7 Sharp | 0 Flat | 1 Flat | 2 Flat | 3 Flat | 4 Flat | 5 Flat | 6 Flat | 7 Flat |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------|--------|--------|--------|--------|--------|--------|--------|
| 0 Sharp | C       |         |         |         |         |         |         |         | F      |        |        |        |        |        |        |        |
| 1 Sharp | G       | D       |         |         |         |         |         |         | B      | A      |        |        |        |        |        |        |
| 2 Sharp | E       | C       | B       |         |         |         |         |         | A      | G      | F      |        |        |        |        |        |
| 3 Sharp | B       | A       | G       | F       |         |         |         |         | D      | C      | B      | A      |        |        |        |        |
| 4 Sharp | F#      | E       | D       | C       | B       |         |         |         | A      | G      | F      | E      | D      |        |        |        |
| 5 Sharp |         |         |         |         |         |         |         |         | C#     | B      | A      | G      | F#     |        |        |        |
| 6 Sharp |         |         |         |         |         |         |         |         |        | C      | B      | A      | G      | F#     |        |        |
| 7 Sharp |         |         |         |         |         |         |         |         |        |        | C      | B      | A      | G      | F#     |        |

Table one.

# The Roland G-77 MIDI Bass Review



When one thinks of MIDI one usually thinks of keyboards. Guitar players have been seriously excluded from the band. The Roland GR instruments offer one a new tune to play.

by Steve Rimmer

In an area of technology which is just dripping with exceptional stuff, the Roland GR instruments are really special. There have been several attempts at creating practical MIDI guitars, but most were so weird and funky... and all but unplayable... that one would have thought that the whole concept was destined for the Twilight Zone. The Roland synthetic axes, however, are eminently playable, unquestionably MIDI compatible and very nearly everything you could want in a guitar that plays through a piano.

In this feature we're actually going to be looking at the G-77 MIDI bass. The GR guitars behave in virtually the same way... except that they have two more strings and they come in more colours. As it happened, when we cruised over to Roland's offices to troll for instruments they'd sold every guitar in the place, and, in fact, were down to their last G-77s.

The G-77 bass and its attendant GR-77B synthesizer can be both a stand alone instrument and a MIDI device. While it's quite the axe in its former incarnation, we're

going to check it out from the point of view of a MIDI instrument.

## Four Strings... No Waiting

The G-77 is, to begin with, a pretty standard



## Roland G-77 MIDI Bass

bass guitar, and should the rest of your MIDI equipment ever get kidnapped by martians, you'll be able to play it as one. It has two pretty normal pickups and a regular audio output jack which can be plugged into an amplifier. It comes with four authentic nickel plated bass strings all ready to play... there aren't any microprocessors in them... and it has a generous assortment of knobs and switches that do the things that knobs and switches usually do on electric guitars and basses.

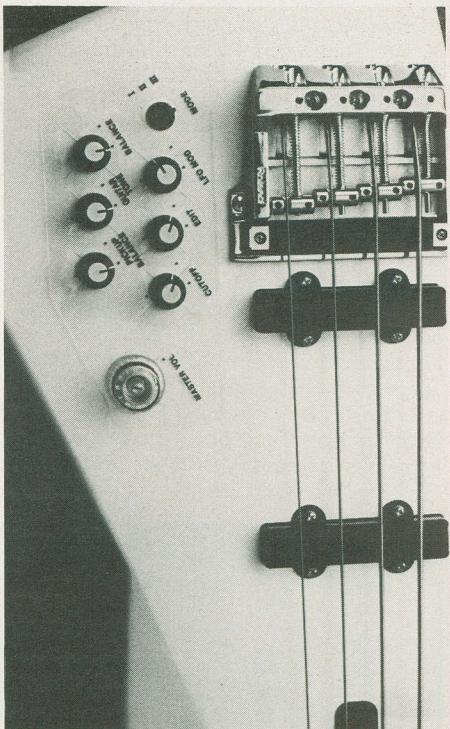
If martians do come to kidnap your MIDI equipment, however, the odds are that they'll take the bass, thinking it's one of them. The G-77 looks like something left over from the last Star Trek movie. It has a very weird shape, and a peculiar, almost metallic paint job. The most noticeable manifestation of its weird design is a black plastic handle... or something... that runs from the head to the body of the bass about two inches from the low side of the neck. I have no idea what this is supposed to be for... the instruction sheet that comes with the guitar calls it a "stabilizer".

Suffice it to say that the stabilizer looks interesting, is occasionally handy to grab the bass by and doesn't get in the way.

The other fittings of the bass are unimpeachable. The neck joint is so solid that it might have grown that way. The bridge is a massive die cast affair with individually adjustable strings. The machine heads move like a greased cat on a skating rink. The large umbilical cable that connects the bass to the synthesizer is fitted with well thought out spring loaded connectors that can't be accidentally pulled out.

The instructions that come with the bass are notable in that they're bilingual... they're in English and Japanese. Among other things, they outline the procedure for adjusting the neck bow of the bass... the G-77 comes with the appropriate wrench to get this together. In fact, the set up on the bass I got was nearly perfect when I cracked the case. Oh yes, it comes in a pretty rugged looking custom hardshell case, too.

The bass itself is actually only half of the whole orchestra. The other bit is the rather unique GR-77B synthesizer. Now, this is appropriate for the bass in that it, too, looks peculiar and, as it turns out, is rather well executed. It's also very large, with huge oversized controls and the biggest numeric displays in the known universe. In fact, it takes one a moment to realize that the syn-



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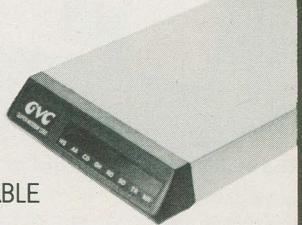
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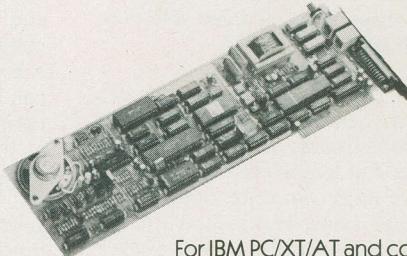
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## Roland G-77 MIDI Bass

thesizer isn't actually meant to be used in the normal sense of computer equipment, that is, by manipulating it with one's fingers. It's intended to spend its life on the floor, with everything controlled using feet.

This, of course, makes lucid sense. If one is playing one's bass... a two handed operation... the average human will have no other free appendages to control things with. The synthesizer is intended to be an analogue for a pedal board.

Most players who have been out of the trees for any length of time have notably less dexterous feet than they do hands. As such, the synthesizer has relatively few controls. There are eleven large foot pedals on it, but in order to get everything together, these have multiple functions. There are also numerous membrane switches on the top surface of the thing, just north of the gaggle

really gets to be a trip. I plugged the MIDI out of the synthesizer into the MIDI in of a Yamaha DX-7... although anything that could have generated sound from MIDI data would have been equally applicable. The resulting instrument is inspiring even in the quietest moments.

If one plays something on the bass the notes will get spewed out of the MIDI interface as data and be played through the DX-7. As such, they'll come up sounding as whatever voice the DX-7 is patched for. One can play virtually any instrument on the bass. This is a lot more remarkable than it sounds, because the way in which one plays a bass is very much different than one would a keyboard or wind instrument. A harpsichord played on the bass is one of the most interesting things you can pour into your ears.



The synthesizer and pedal actuator.

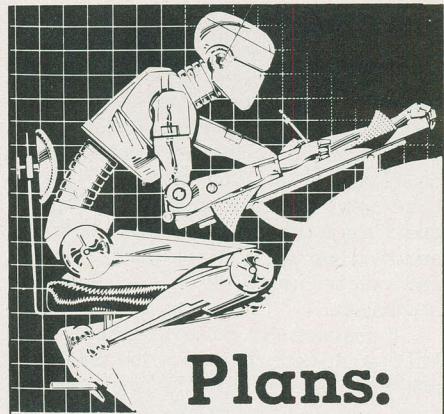
of pedals. These are a bit incongruous with the foot oriented concept of the instrument. In order to use these one must either bend down and stab them with a finger... awkward and, depending on the sorts of places you play, potentially dangerous... or attempt to actuate them with a toe.

In fairness, the membrane switches ordinarily don't have to be meddled with during a performance.

### Rockin'

The synthesizer actually performs a number of functions for the bass... of which we're only going to look at some. It is a very powerful synthesizer in its own right, doing some first rate noises... however, it lacks a MIDI in jack, making it impossible to play as a MIDI instrument. This is a serious drag, because the sonic things that the synthesizer is able to do when controlled by the bass are really decent.

On the other hand, there is a MIDI out jack, and, as such, the bass can ultimately generate MIDI note data. This is where it



## Plans:

### Hardware:

### G-77 MIDI Bass, GR-77B Synthesizer

Roland Canada

\$1,550.00 (G-77)

\$2,250.00 (GR-77B)

Steve's Music, 415 Queen

Street West, Toronto,

Ontario M5V 2A5,

telephone (416) 593-8888

### Manufacturer:

Roland Canada

Retail Price:

### Availability:

It would have been tricky to have put a hundred and twenty-eight foot pedals on the synthesizer to allow one to conveniently change the voices on a MIDI sound source. As such, the eight pedals send out voice change messages corresponding to the first eight voices. In other words, jumping on the pedal with a "2" on it will make the DX-7 select its second voice. The currently selected voice comes up on the right hand gargantuan LED display.

Prodding the bank pedal and then a number will set a bank for the voices, as displayed on the left display. This will take a bit of arithmetic to decode. If bank three is selected and the voice number is four, the voice which the DX-7 will play will be

### (8 \* 3) + 4

or twenty-eight. This does take some getting used to, but it makes practical use of a finite number of foot pedals. In practice, it entails some forethought to make it work properly... one needs to arrange the voices in whatever will be generating sounds at the other end of the MIDI channel such that one need not change banks too often.

The other interesting pedal on the board is the one marked "hold". In playing MIDI instruments, whatever is generating the notes... the bass in this case... must send one clump of numbers out over the bus to turn on a note and another clump to turn it off. The hold pedal suppresses the note information and, as such, allows one infinite sustain. There are two modes for it, selectable by membrane switches. It can either hold for as long as the pedal's down or it can toggle... stab it once to set the hold on and again to shut off all the held notes.

## Roland G-77 MIDI Bass

This is a great feature, something which can only be approximated with a normal electric bass. It will sustain for half an hour if you want it to.

### Heavy Metal

There are a few peculiarities in playing the bass... you'd kind of expect these. However, the thing that makes the bass so incredible is how much it really does behave like a normal electric instrument. It doesn't suffer from any of the settling problems that other attempts at MIDI guitars have encountered, that is, it doesn't have to think about which note one has hit for a while before it spews its MIDI information out over the bus. Even the really low notes seem to get called instantaneously, which must have been a neat trick to get working properly.

The really weird bits of the bass are in its tuning. The bass is, after all, still a normal stringed instrument, and, as such, can be tuned to anything you want it to be. It doesn't necessarily have to match the tuning of the synthesizer you're going to play it into. As such, if you tune it slightly off the scale of the instrument it will be controlling, things can get a tad confused. The notes will jump around and the whole effort will behave rather unstably.

This is where the regular electric pickup becomes quite handy. You can plug it into an amp and hear both what the bass is tuned to and what the synthesizer is doing. You don't even have to hold a key down on the keyboard the bass is playing through while you're tuning it. So long as the bass was close when you started, the MIDI data will sound the appropriate note on the keyboard. You can just crank the machine heads on the bass until the two notes are at the same pitch.

When it's properly tuned, the bass is a rock. It never goes out of tune. In reality, it may well drift around a bit... most basses do. However, because MIDI notes are integral... they only exist in steps of a semitone each... the tuning of the bass's strings would have to drift about a half a semitone before it would affect the notes coming out of the keyboard. It never gets anywhere near this far out of tune.

Aside from transmitting MIDI note data, the bass is surprisingly good at translating string voicing into MIDI terms. The MIDI note velocity parameters will correspond pretty closely to the way you hit the strings on the bass.

You can play most normal bass things on the G-77. There are, however, some bass techniques that just aren't applicable to it. String popping, for example, seems to leave it in a state of apathy... it plays popped notes just like regular ones that have been hit unusually hard. Hammering on the strings takes some practice... you have to learn to do it carefully or it can generate a few of spurious notes. Slides up or down a string sound incredibly crisp, especially if you're

playing the bass through a fairly simple voice.

The bass seems to totally ignore string harmonics, generating no MIDI data at all for them. This is a drag if you habitually use them for effects, of course, but it makes tuning the bass a lot easier.

### Fortissimo

The G-77 bass is a glorious MIDI controller... an authentic technological party to play. While it would seem to be just another way to generate notes, the effect of playing

things on it is different from what it would be on a keyboard. It lets one put a lot of breath into one's music.

To a large extent, the absolute usefulness of the bass... or one of its related guitars... will be determined by what you like to play and what you play on it. Heads who are exclusively into keyboards won't be all that enraptured by it. Traditional bass and guitar players, on the other hand, should expect to be blown away, and be wholly unreachable for other things for at least a week.

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# BASIC on the Atari 520ST

Pioneer users of the powerful new Atari systems may well want to know what the languages are like on it. Here's a PEEK.

by Frank Lenk

**T**he new sixteen bit Atari is a hot little machine at a very hot little price. It's been available for less than a year, but software is already flowing at a highly encouraging rate. Still, for the questing spirits among us mere canned applications will never be enough. To really master the machine we have to get our fingers dirty, to get right into the guts of the system.

Atari has provided two tools to aid one in this endeavour. The 520ST ships with both BASIC and LOGO as standard equipment, although... thank the gods... neither is built into ROM. The two languages are

loaded with nifty sixteen bit features, and will even let you reach right in and grab the GEM/TOS operating system by its roots. Although the BASIC is as yet far from perfect, it's not bad as BASICs go, and certainly well worth some extended exploration.

## BASIC Principles

The very first thing that will strike any user of the current Atari ST BASIC is how badly it uses the GEM windowing environment. This is a problem already acknowledged by Atari itself. A new version of BASIC that will

hopefully alleviate the situation is on the way. In light of this impending upgrade, you can take it as read that all comments regarding the present version are intended to be preliminary impressions rather than lasting blandishments.

Atari BASIC presently seems incapable of operating at all with less than four separate windows at its disposal. There's a Command window, a List window, an Edit window and an Output window. This profusion could be kind of embarrassing to the BASICA hacks who've naively been making do with just a single screen space for all

## BASIC on the Atari 520ST

these functions.

Fortunately, in practice you can totally ignore the List window, since this function is amply supplanted by the Edit space. I eventually found that a tiny Command window was enough for typing commands like RUN, and that a more substantial Edit window could be kept out of the way and brought to the surface by typing ED in the Command window. This let me set up a large Output window that occupied almost the entire screen. Unfortunately, BASIC has no function equivalent to GEM's "Save Desktop", so the window arrangement has to be manually redone every time you fire up.

Also, you'll notice that mouse clicking is not properly supported. Clicking on the edit window by no means puts you in edit mode. Instead you simply lose your cursor. Mousing is only good for moving the windows around. To select functions you must either type a command or pull down a menu.

While on the subject of windows, it is probably more important to note that BASIC gives the programmer very little direct control over windows during execution. Windowing commands are limited to OPENW, CLOSEW and FULLW for opening, closing and expanding the window to full screen. If you've visions of having your program popping windows open and shut all over the screen, forget it. All you get is the single output window... open, shut or full screen.

In program statements, windows are referred to by baffling number codes:

```
0 edit  
1 list  
2 output  
3 command
```

On the other hand, menu control is quite good. The desk pulldown still lets you get at the control panel and other goodies. The entries for FILE, RUN, EDIT and DEBUG duplicate a number of useful commands. EDIT, oddly enough, duplicates all the editor function key commands, and adds help as well, a little menu of what the function key assignments are. I'd print this and tape it onto my monitor. I have a tough time associating F5 with the function page down.

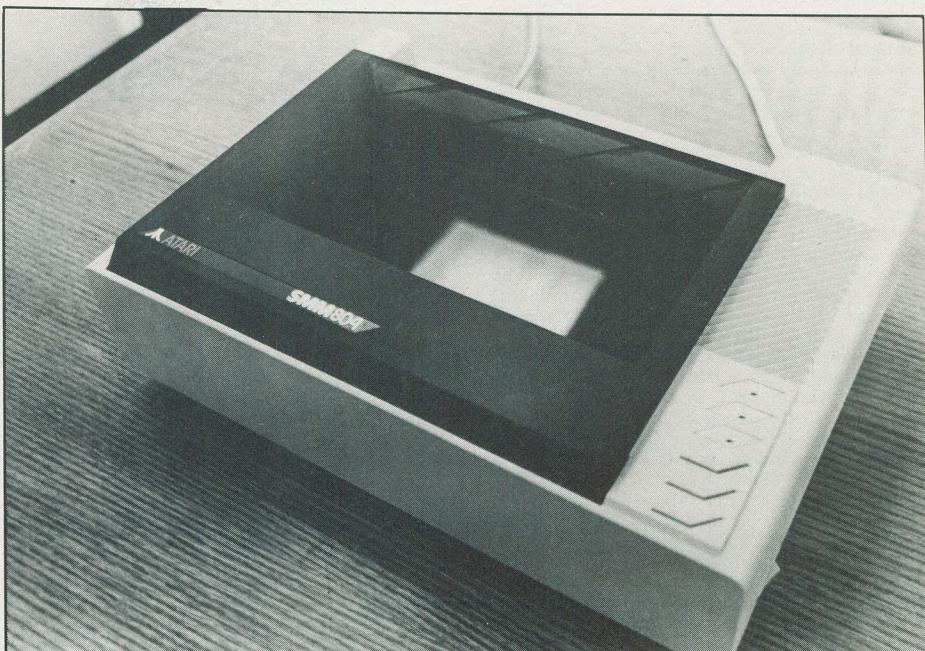
On the plus side, the editor does incorporate a good selection of utility commands, like automatic line numbering, RENUM for renumbering and MERGE for combining two programs.

As BASIC dialects go, the ST's is not bad... and highly similar to standard Microsoft. It provides the usual types of GOTOS and GOSUBs, together with the ability to use line labels. However, there is no other attempt at structuring. Loops are of either the FOR...NEXT or WHILE...WEND varieties. Variables can be integer, string, as well as either single or double precision reals. VARPTR... as in Microsoft BASIC... returns a pointer to the location of a specified variable, so that you can access

the value from CALLED machine language routines.

Machine language interfacing is available via the usual PEEK, POKE and CALL statements. System routines can be accessed using the commands GEMSYS and VDISYS. However, there's no

commands PCIRCLE and PELLIPSE are supposed to create filled circles and ellipses, but I could not get them to perform as advertised. The one line example command in the BASIC source book will not work as written. Similarly, the ability to control fill patterns and colours using the SETPAL and



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documentation included to let you know what the GEM and VDI routines are, so you can plan on investing in some extra literature if you're into this sort of hacking.

DOS type file access is available, via commands such as ERA and DIR. However, there seems to be no equivalent to the Microsoft SHELL command.

Debugging aids include TRACE, UNTRACE, TRON, TROFF, FOLLOW and UNFOLLOW commands. All can be accessed from a pull down menu. The command STOP can be used to halt execution in the middle of a program, dropping to break level rather than gracefully shutting down whatever is going on.

Strangely enough, the existing ST BASIC gives one only very incomplete control over screen colours. You get the usual four colours in medium resolution mode and sixteen in low res, but there is no... easy... way of switching these around. The only way I could find was to use the control panel, as you would in desktop operation. This is not something you can get at from inside a program... at least not without direct meddling with GEM. Similarly, your programs will not easily be able to select low or medium resolution modes.

The BASIC includes lots of useful drawing commands, such as FLINE, ELLIPSE, and CIRCLE. However, there are no rectangle commands, and no command equivalent to Microsoft DRAW. The com-

PALETTE commands seems rather flawed. Patterns are selected by code numbers, and I could only get at the first few patterns of the set shown in the documentation.

There are a couple of other things worth watching out for. One of them is memory availability. Unless you've got the new operating system ROMs, you may easily find yourself running out of RAM space. If this happens you should switch the buffered graphics off. BASIC will release a considerable amount of buffer space for program use.

One final small point. Once you've created some pretty looking stuff in the BASIC output window, be careful not to destroy it accidentally before you can get a printer dump to show your friends. Sliding the mouse or a pulldown menu over the Output window is safe, but moving another window over output will permanently wipe out whatever was displayed. It seems silly, but if you're not careful you can find yourself running the same program two or three times just to get one clean result.

The new version of ST BASIC is due out by May. It's being designed in England by Metacomco. A new set of manuals is already in print, for both BASIC and LOGO. Both manuals will be small coil bound booklets, attractively printed on glossy paper. The content seems unchanged from the existing source book, but the layout seems a lot better.

## BASIC on the Atari 520ST

### The Rumour Mill

Lots of other good things are coming up from Atari. The final TOS and GEM ROMs should be retrofitted across the board by the time you read this. No further machines are being shipped with disk based operating systems. The ROM based GEM will retain the original Digital Research look, without any of the cosmetic alterations added to the IBM version in order to appease Apple. The final ROM operating system seems to have only one remaining known bug, involving difficulties with serial transmission at twenty-four hundred baud.

Aside from freeing up two hundred kilobytes of usable RAM space, the new ROMs will let the ST boot at a very speedy pace. By my rough timing, the system at Atari took about five seconds to bring up the desktop display, and another second or so to show the directories for any open disk drive windows. The number and position of windows initially open, along with screen colour, will still be configurable by means of the small "desktop info" file. As with the disk based system, this file will be read from whatever disk is available at boot time. Similarly, desk accessory programs can be loaded from any available drive, including the soon to be available hard disk.

The hard disk itself will be a twenty megabyte unit, and should be on the dealers' shelves by mid April. The self-contained box will add yet another power supply to the total system, and will sell for a rather hefty twelve hundred and fifty dollars Canadian. Initial sourcing is said to be within the States, and prices ought to come down when a planned change is made to far eastern manufacture.

Atari is also following up with a new line of peripherals. Among the first of these will be the SMM 804 dot matrix printer. No pricing is available as yet, but it's obvious from the specifications that this is an unremarkable little beast. Its draft mode speed is rated at eighty characters per second. The usual effects are supported, including pitch, elite pitch, double wide, compressed, underlined, subscript, superscript and so forth. However, there's no mention of the fancy near letter quality modes common to the latest generation of nine pin matrix printers.

Atari 520ST owners wanting to keep pace with the new one megabyte 1040ST will probably be able to choose from several upgrade paths. Additional piggyback RAM chips will be available for mounting directly on the motherboard. One such package is reportedly coming from Habs Systems.

A more far reaching add on is the new expansion box, due out from Atari in the latter part of this year. Connecting to the DMA port, the eight slot chassis will include a power supply. Users of it will be able to consolidate all of their disk drives, including both three and a half and five and quarter inch floppies as well as a hard disk. This should cut down considerably on power cable clutter. Several option cards are being promised for the expansion box. An IBM emulator is expected to provide an eight megahertz 8088 and a half megabyte of RAM for only about three hundred dollars. Atari is also working on a 68020 board for heavy duty thirty-two bit computing capacity.

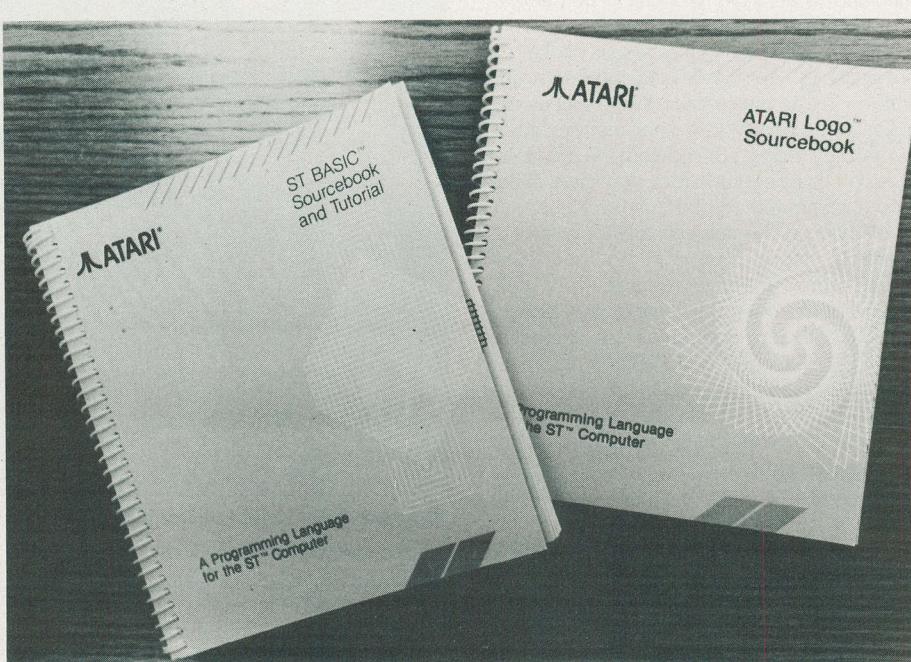
The 68020 upgrade leads naturally towards Atari's planned top end system, the EST. Planned for introduction late this year, the EST will offer an entirely new level of colour graphics, with a palette of

4096 colours. New graphics modes will give vertical screen resolution roughly double that of the existing ST models. The lowest resolution mode on the EST will allow for two hundred and fifty-six colours on screen at one time. The monochrome display will have a resolution of about 1280 by 960. These numbers would have sounded like a pipe dream just a few months ago. Now it's really only a matter of time.

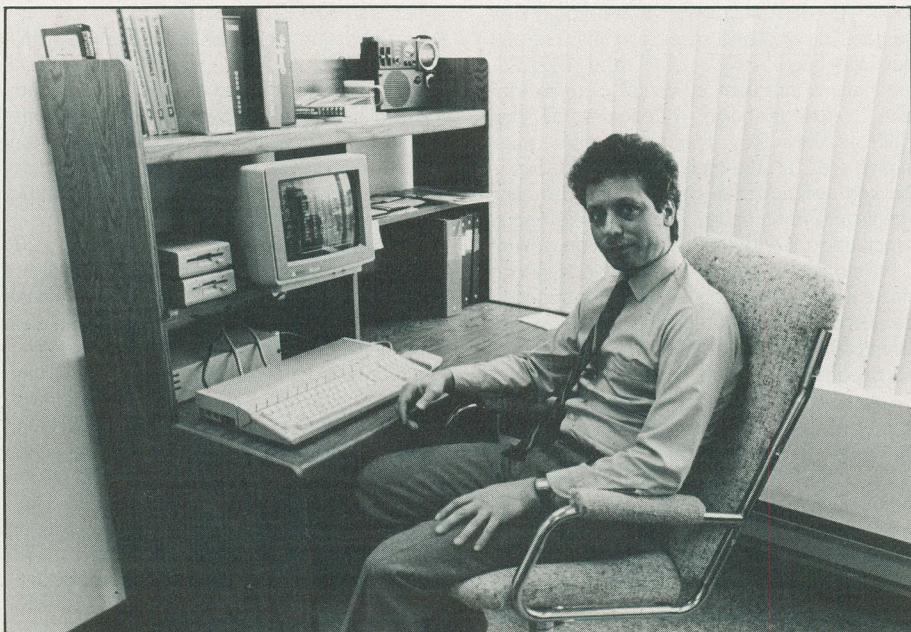
The ST is starting to notch up some solid sales statistics. Close to fifty thousand

STs have now been sold in Germany alone... nearly half of the worldwide total. England has not been quite the volume success that Germany has been, but it has come through with a surprising volume of software... probably the result of prior experience with the 68000 based Sinclair QL.

The sales of the system in Canada are probably over the six thousand mark. The expected Christmas rush apparently materialized just a few days before the holiday, leaving many dealers with empty shelves.



The new Logo and BASIC manuals



Atari's Joe Ferrari sits with his hard disk 1040ST.

# Almost Free DX7 Voices

## for the IBM PC

The Yamaha DX-7 is one of the most powerful MIDI equipped synthesizers on the planet. One of the things that makes it so unspeakably slick is its capacity for having its preset voices loaded through the MIDI port. You can store banks of voices on disks and send them to the DX-7 almost instantly when you want them.

While there are numerous DX-7 voice librarians available, many replete with pots of voices to use, these things are nasty and expensive and very often fairly complex to operate. When all you really want to do is to port voices. As such, in the tradition of almost free software, we've assembled a collection of almost free DX-7 voices. This includes a whole disk full of voice libraries and a really snappy little utility to send them over to the DX-7.

If the voices that came with your DX-7 blew you away, these libraries will send your brain into several other higher order dimensions at once. They range from the most sublime recreations of acoustic instruments to freaky, bizarre effects certain to be overused at least once. We've assembled them into performance groups to make them immediately useful, and made them compatible with the DX-Archive voice librarian software to make them easy to re-organize if you want to. The DX-Archive program is available separately... check out the details below.

There are libraries on the disk of percussive effects, woodwinds, a whole set of pianos, heavy metal noises, string and brass sections, funk collections, baroque collections, rock collections, jazz collections and a few collections that defy description. There are enough voices here to keep your DX-7 confused for your lifetime and that of your immediate descendants.

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plus the DX-7 voice transfer program... is  
available for a mere

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or you can order by phone and be up to your navel in voices  
in a couple of days. Call

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have your Master Card, Visa or American Express card ready.

The DX-Archive voice librarian software is available separately for \$39.95 from XLelectronix Computer Music Centre, 317 College Street, Toronto, Ontario M5T 1S2. It provides complete voice bank transfer facilities plus a convenient method for re-organizing the voices in multiple libraries.

**Fine Print:** These voices have been designed for the Yamaha DX-7 synthesizer. While they will probably work on other, similar Yamaha instruments, they have not been tested on anything other than the DX-7. Instruments with synthesizers having fewer operators, such as the DX-9, may experience sonic peculiarities in using some of these voices.

The use of this collection presupposes the availability of an IBM PC or compatible computer, DOS 2 or higher and a Roland MPU-401 MIDI interface.

Moorshead Publications warrants that these voices will be readable when you get them. The post office, however, may have ideas of its own. If your disk doesn't function properly when you receive it please contact us for a prompt replacement.



# Video Cassette Recorder Data Backups

There are a lot of things that store lots of data without our ever noticing it. Video machines are certainly among them. This innovative new package allows one to use a VCR to back up computer data.

by Frank Lenk



The coming of the hard disk has been an enormous boon to heavyweight computer users, but the power has come at a price. It's a lot like having all your eggs in one basket. Instead of losing the three hundred and sixty kilobytes or so on a single floppy, you are now able to wipe out ten, twenty or even thirty megabytes of valuable information at a single, convenient stroke.

If you're halfway sane, this ominous fact may weigh heavily upon your nervous system. No matter how far we've come with hardware reliability, the only real insurance is backups, and backups of the backups. All this backing up runs into both time and money. Aside from the sheer expense of

backup media, there's the hours of operator tedium required to ensure that everything is regularly transferred to the archive.

A new solution may alleviate these worries. Using a plug in PC bus card you can now salt away up to about eighty megabytes of digital data using any standard video cassette recorder and video cassette tapes. It will work with both VHS and Beta format.

## Alpha Bet

The name Alpha Micro is not one that is commonly bandied about in microcomputing circles, although the company itself is one of the oldest in the business... founded one month after Apple. Up 'til now, Alpha

has specialized in multiuser and multitasking computer systems. However, its newest product is something that even the lowliest hard disk user can sink his teeth into, the Videotrax VCR backup system.

In principle, there's no reason why the magnetic tape inside a video cassette can't be made to bear digital computer data. The trick is to interface the two technologies. Videotrax certainly makes this a painless procedure. One just plugs the card into a PC, plugs the output end into a VCR, and thereupon runs a special menu driven backup program.

In addition to the PC version, Videotrax is available for various other types of hardware... including venerable S-100 bus

## VCR Data Backups

systems. The interface board even takes a personality ROM that will let it produce video output to conform to North American NTSC or European PAL and SECAM standards. A Z80 runs the whole system, controlling the data throughput, generating checksums and adding the necessary video sync signals.

Videotrax crams about eighty megabytes of data onto one two hour tape. Actually, you could double the density by running the VCR in the four hour, higher speed mode... but that would be getting greedy. The Videotrax board converts digital output into analogue bursts, each containing five hundred and twelve bytes of data and a CRC checksum. By default, each block is recorded four times, although the user is free to specify either a higher or lower security factor. When data is restored, the Videotrax software automatically rejects any damaged blocks and switches to one of the reserve copies of that block. If you're really nervous, you can even request a full verify backup, which double checks each block as it is written onto the tape.

The Videotrax software looks like it should provide even the completely unknowledgeable operator a good degree of control over the backup and restore operations. The main menu looks like this:

- 1 - Backup
- 2 - Restore
- 3 - Tape Directory
- 4 - Tape Quality Check
- 5 - Process Audit Trail
- 6 - System Setup
- 7 - Exit

You can select either file by file or a full image transfer. In the latter mode, the Videotrax system saves only actual data, without wasting time on blank disk sectors. When restoring a complete hard disk image, Videotrax once more shows its smarts by allowing the information to be rearranged to match a new bad sector map. This could be important if the data is to be restored to a different hard drive than the one it originally came from, or if the original drive has needed reformatting after a crash.

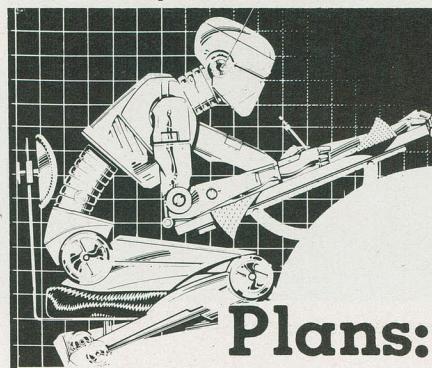
The quality check operation will produce a total number of bad CRCs on the tape... a soft error... and the number of data blocks with no remaining good copies... a hard error. It then divides the total number of blocks by the number of soft errors and gives the result as a reliability factor. Anything below a hundred to one means that you have... at least... dirty tape heads, and possibly some more serious problems.

Audit trails allow the user to keep track of which files have been archived, and when. Unattended operation can be programmed using the VCR's timer, so that a preselected backup procedure can happen at night without disturbing anybody.

The backup speed is not bad at all, running to about eighty seconds per megabyte. That translates to about half an hour for the

average twenty meg drive. To fill an entire tape... though god knows how you'd do it in a single session... would take about two hours.

The file by file modes will often need



### Plans:

Name: Videotrax  
S y s t e m : IBM PCs, XT's, and AT's and compatibles  
Facilities: Backup subsystem, using VCR technology, either VHS or BETA.  
Manufacturer: Alpha Microsystems  
Available from: Olivetti Canada, Mini Computer Division, 3190 Steeles Avenue East, Markham, Ontario L3R 1G9, telephone (416) 477-8250 ext. 293  
Price: \$2,290.00 with VCR,  
\$995.00 without

considerable operator intervention, such as pushing the fast forward and rewind buttons on the VCR until the desired files are located. To avoid this hassle, the simple solution is to buy Videotrax complete with its own VCR. This is a standard Sharp machine, relabeled with the Videotrax logo, and containing several interfacing enhancements that will allow the Videotrax card and software to directly control the tape drive. Unless you already have a VCR that you want to use, this would certainly be the way to go.

Once the software gets total control of the VCR, it can act like a... rather slow... disk drive. Files can be found and retrieved directly from the Videotrax software, with no recourse to the hardware at all... save perhaps for changing tapes now and then.

The Videotrax VCR is not the cheapest one you can buy, but then the whole Videotrax system is not all that expensive, in corporate terms at least. For about eight hundred dollars US you get the basic Videotrax board and the software. For about sixteen hundred you can get the board, software and have a VCR thrown in. This obviously is not mere peanuts, but it does compare very favourably with the expense of the average streaming tape backup unit. Furthermore, Videotrax gains ground on the basis of tape costs. An average video cassette costs less than ten dollars, as opposed to something over twenty dollars for many streamer tapes.

Canadian support for the system is rapidly on the way. The VCR itself should

be CSA approved by the time this sees print. A spread of about thirteen distributors covers all the major Canadian cities. Olivetti Canada has been signed as the local service and distribution agent. Olivetti has been busy already. About two hundred Videotrax units have apparently already been sold to the Archdiocese of Quebec.

### Television Networking

Although Videotrax is unquestionably an excellent solution to the archiving problem, its real potential goes far beyond this single application. Once you have converted your data to analogue video form, there turn out to be a number of interesting things you can do with it.

Assuming you put a full eighty megabytes of data on a tape, you would then be able to transmit all of that information... by normal video channels... in just the normal playing time of the tape... about two hours. One of the demos shown by the Videotrax folks concerned an experiment conducted by a BBC TV science program. These folks showed the entire text of the novel *Alice in Wonderland* being beamed across town in the space of a few seconds.

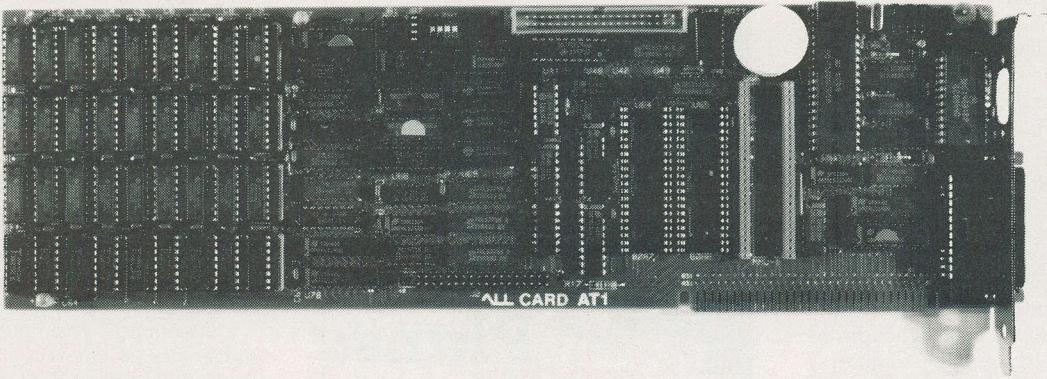
For a corporation wishing to move data to several remote locations at one time, this represents a great potential saving. A company could rent satellite transmission time and beam its data directly to several stations simultaneously, for considerably less than the cost of traditional modem communications.

A more user oriented benefit of the Videotrax concept might lie in the direction of integrated video and data presentations. With both software and video mixed on the same tape, all you need is a monitor that can switch from TV to RGB display under program control. Alpha Micro is already looking into the possibility of supplying an external adaptor that could support this sort of thing. Within the next six to nine months the company expects to have a production facility up and running for the creation of its own interactive video presentations.

Another application being promoted by Videotrax is the use of tape as a medium for software distribution. Considering the growing size of big business applications, high capacity tape could make a niche for itself. Alpha Micro has already built in the capability for Videotrax tapes to be self booting and copy protected. A personality PAL chip will allow software to fingerprint the hardware as it boots, so that it can be set up to run only with the purchaser's original Videotrax board. An eight millimetre version of Videotrax will allow a self contained, compact backup unit to be fitted internally within a traditional PC cabinet.

Finally, there's one other major... financial... benefit of the Videotrax concept. It allows the crafty businessman to write his VCR off as a business expense. Just don't tell anybody we suggested it...

# The PC ALL Card Review



**When you need gallons... or perhaps litres... of memory in a PC you need more than just chips. This card features a clever solution to the PC's fragmented memory space.**

by Frank Lenk

**W**hen IBM was designing the PC, the question of memory capacity inevitably came up. Since nobody had yet pushed the limits of what could be done with sixty-four kilobytes of RAM, IBM and Microsoft arbitrarily set the boundary of DOS at ten times that amount, a vast six hundred and forty K. Above that limit they stashed the video buffer and various other chunks of the operating system.

There's a strong temptation to lambaste IBM and Microsoft for this short sighted decision. Actually, it is only in my own twenty-twenty hindsight that I can be so critical. It took years for applications software to consume the full capacity of the IBM PC. Now that we can buy programs that won't even run in less than a half megabyte of RAM, we all complain loudly that IBM should have done things differently.

Whether things should or should not have been different, we must make the best of the situation as it stands. Fortunately, there are a number of ways of breaking through the memory barrier. Lotus was one of the first software publishers to need more RAM... in their case, to allow power hungry users to run monstrous spreadsheets. The Lotus Intel Microsoft specification defines a standard protocol for bank switching extra RAM into the available address space.

This solution may look adequate in the short term... but then, so did IBM's decision to go with the existing memory space. A Canadian company... ALL Computers... has taken a more far ranging look at the RAM situation, and has created its own extended memory standard. At first glance it is

not easy to see exactly how the ALL card is superior to the Lotus Intel types. However, once you get the full tour the difference begins to resemble the technological gulf between the PC and an abacus.

## The Left Bank

ALL's advertising proudly proclaims that "This is not BS... not bank switching". This catchy pronouncement really does cut through to the essence of what makes the ALL card a better memory expansion system.

In its minimum configuration, the ALL card provides conventional multifunction features like a serial port and a real time calendar and clock. Any RAM on the board... up to the usual six hundred and forty K maximum... can be used like normal memory, and addressed transparently from DOS. As a RAM board, the ALL card has the one advantage that it lets you mix sixty-four and two hundred and fifty-six K chips. You can purchase the basic board with three hundred and eighty-four K on board for six hundred and fifty dollars. This is not that much more than comparable name brand multifunction hardware, and might be a good way to go if you anticipate needing extended RAM capabilities later on.

To expand to full configuration will mean laying out another six hundred and forty-five dollars for the MMU-1 module. This sockets onto the original board and adds multimegabyte addressing. Eventually you can also pick up the piggyback card, which adds up to another five megabytes of

RAM using one megabit chips. An optional battery unit can make all the piggyback memory nonvolatile, which could save considerably on boot up delays.

Once equipped with the MMU-1 module, the ALL card provides true memory management capability. This is built right in to newer chips like the 80386 or older minicomputers like the PDP 11/70 and VAX. In the case of the ALL card it is supplied by a separate CMOS chip, the memory management unit. This chip, plus some software system drivers allows the 8088 chip to address a vast new memory space. The MMU intercepts bus access directly at the CPU and reroutes it to the extra RAM.

With simple bank switching, your first problem is to find somewhere to switch extra memory into. Although the IBM PC can address up to a megabyte, the top section above six hundred and forty K is all cluttered up with system areas, twenty kilobytes for the video screen in one place, eight more for hard disk support in another place, another few kilobytes for the ROM BIOS, and so on. Each of these address areas is in a different sixty-four kilobyte block, leaving only three blocks that are not messed up in some way.

The Lotus Intel Microsoft expanded memory standard allows addresses in high memory to be switched for extra RAM, in banks of sixteen K at a time. Thus you can have up to four megabytes of expanded RAM, but you can only see sixty-four kilobytes of it at any one time. The ability to split a sixty-four kilobyte window into four

# Almost Free PC Software

## Volume IX

The premise that good software ought to be cheap isn't one that the microcomputer industry as a whole seems to embrace, what with most programs costing several hundreds of dollars... and usually being copy protected, infested with bugs or poorly documented when you finally do get them. We think that cheap software is almost as fundamental as clean water and classic Coke.

This ninth volume of our popular almost free PC software represents another superb collection of programs for the IBM PC and compatible systems. Whether you're into games, business, hacking or just being in the same room as a microcomputer, this disk will enhance the usefulness of your PC at a cost that won't even dent your wallet, let alone blow it out of the sky as most applications packages can.

**Small C** If you've ever wanted to try writing programs in the C language, this compiler will fascinate you. It's a restricted implementation of C, producing code which is compatible with Microsoft's MASM and LINK programs... you'll need these to get it going.

**Map** is an interesting little utility which will check how DOS is situated in the memory of your computer and tell you a number of things about it. It's a useful programming tool, especially helpful if you're debugging software which interacts directly with DOS.

**Note** is the source file for the memory resident note pad that we ran in the March 1986 edition of Computing Now!. It requires MASM and LINK to use. It will create a resident memo page that you can call up from within any application.

**Pango** is one of the wildest games we've come across for the PC. While its premise is a bit improbable, it's fast and weird and more fun than a stoned house cat.

**PC-Spell** is a pretty decent spelling checker written in BASIC. Despite its pedestrian sounding origins, it's fast, accurate and easy to use. It can be listed if you want to see how it works, and comes with a large dictionary file and a utility to assist you in customizing it.

**Peacock** is a memory resident program which allows you to change the colours of your screen with alternate function keys. It's useful, for example, if you run software which insists on changing the screen to something loathsome.

**Recover** is a utility to assist you in getting data back from damaged files. It lets you look at your files one sector at a time and put the pieces back together.

**SDB** is a small relational database. It isn't dBASE III, but it also doesn't cost quite as much. It's still pretty powerful and is eminently suitable for many business applications. It features on line help.

**Tally** is a program which accurately counts the number of characters, words and lines in a file... all within your lifetime.

**Xeno** edits the tracks and sectors of your disks in a user friendly format... or, at least, one that doesn't lunge for your throat every time you boot it. You can use it to explore DOS, fix trashed disks, unerase files and do all the other low level magic that sector editors are renowned for.

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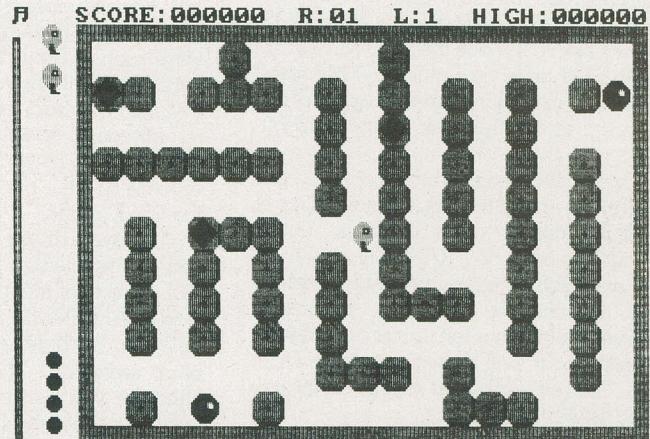
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Have your Master Card, Visa or American Express card ready.

**Fine Print:** This software has been collected from public access bulletin boards and is believed to be in the public domain. We have checked this software carefully to insure that it functions as it should. However, we cannot assist you in adapting it to your specific applications.

Moorshead Publications warrants that these programs will be readable when you get them. However, magnetic fields, cosmic rays, truck tires or the bends may adversely affect your disk in transit. If it doesn't function properly when you receive it please contact us for a prompt replacement.

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## The PC ALL Card Review

chunks can help cut down on switching. Newer cards such as the AST RAMpage actually allow up to eighteen pages. Still, a spreadsheet user can quite easily put the system into a "thrashing" state, where distant pages must be retrieved over and over in succession as some operation is performed on a large section of the worksheet.

What's more, swapping in a new page requires about one hundred instructions to be executed within the expanded memory manager... costing about one thousand processor cycles. By contrast, the ALL card can flip a one megabyte RAM window with just a single instruction. The ALL window size can be varied, from four kilobytes up to a full meg.

It's not always easy to get some use out of all your extra RAM. Right now, there are several ways of using the ALL card. Up to nine hundred and fifty-two kilobytes... including what's already on your motherboard... can be used straight from DOS. Memory above the one megabyte mark can be accessed only via Lotus Intel Microsoft emulation... in conjunction with appropriate software... or as a ramdisk, using ALL software.

One of the things which the ALL card offers is the ability to tuck a whole mess of co-resident utilities... like SideKick... out of the way into extended RAM. This will need some extra software, and probably means a patch to some of the utility programs. However, only about ten percent of the normal utility code will show up in your DOS space. The rest will be out of sight, in the extended RAM.

With the ALL Card, the first 952K of memory space is available transparently to virtually all DOS applications. This means you can run CHKDSK and see the extra RAM. Most of your programs will use the extra RAM without a hitch. A few programs that cheat on video access can also use the extra RAM, but require a simple bit of patching. ALL specifically mentions APL, Turbo Pascal, C86, Crosstalk, the IBM Macro Assembler, Multimate, WordStar, dBASE, Pascal, BASIC, Multilink, PC Net, Novell network and SideKick as working with the extended DOS space. In a demo at ALL I actually saw Lotus Symphony... presumably a patched version... give an appropriately massive response to the standard space available query.

At the heart of the system is a driver called ALLMOS.SYS... the ALL memory operating system. This intercepts calls to the ROM BIOS and arranges for the MMU to be engaged as needed. A program called ALLSIZE.EXE is used to specify the size of the desired DOS space. If you ask for a big space, video RAM... normally between 704K and 768K... must be relocated, as must the hard disk control and BIOS ROM areas. Roughly speaking, the ALL system remaps video and the BIOS into the area

from 960K to 1024K. The BIOS is usually banked out, and flipped back into addressable space only when the ALL drivers sense that it's needed.

Video space presents the greatest problems, owing to the large number of commercial packages that write directly to screen RAM. You can get around this either by limiting DOS space to about 704K, or by patching your applications. A program called ALLPREP can automatically patch common software such as Lotus, Framework or Topview. Changes... it says here... are not hazardous, and are completely reversible. The easiest programs to modify, of course, are ones like Lotus that have separate screen driver files. In these cases your original program is untouched, only the driver is modified.

The 952K space should be enough for all but the most memory hungry users. Of course, no matter how much RAM you've got, you can always find a way to use a bit more. If you have already invested in software such as Lotus that has bank switching capability built in, you will be glad to hear that the ALL card can emulate the Lotus Intel Microsoft specification. This mode of operation will let you access four megabytes of RAM space... but it won't be as fast as the the 952K mode.

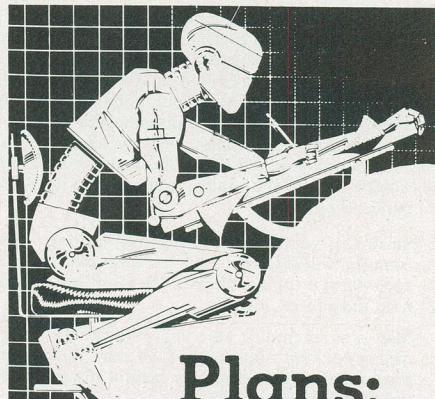
A device driver called ALLEMMS.SYS can be installed at boot time to allow the ALL card to fit into the Lotus Intel Microsoft world. ALLEMMS tries to find an empty sixty-four kilobyte "pageframe" location for bank switching. This is usually ODE00H, although you can override this value and put the pageframe buffer where you wish. You can use the ALLSIZE stretched DOS space together with ALLEMMS, although the DOS area will have to end below whatever point you pick for your pageframe. A handy utility called EXAMEM can be used to remind you what RAM has been assigned to what function, such as BIOS, other ROMs, video, RAMdisk or vacant DOS space.

Setting up the ALL card is simplified by a friendly installation program that comes with the hardware. The user sees a pictorial representation of the card, and answers a series of questions as to the desired configuration. You need all the help you can get, as the printed documentation points out rather a lot of possible memory layouts, depending on what chips you've plugged in on your card.

The documentation for the ALL card is generally well written and complete. However, it is a bit hard to keep track of at this point. There's an instruction and technical reference booklet that provides a lot of technical information about what chips go where. However, the software docs reside on the system disk, in a file called ALLMOS.TXT.

To install the ALL card you have to actually pop out your processor chip... or

chips... and install them directly on the ALL Card. The 8088, and the 8087 if you have one, go into sockets on the board, and a jumper goes back down to the vacated socket on your motherboard. This way the ALL card is able to take complete control of memory access. The chip swapping procedure is not complicated, but it probably



## Plans:

|                                  |  |
|----------------------------------|--|
| Hardware:<br>System:             | ALL Card<br>IBM PCs, XT's and compatibles  |
| Manufacturer:<br>Available from: | ALL Computers<br>ALL Computers Inc., 102 Bloor Street West, Suite 1200, Toronto, Ontario M5S 1M9, telephone (416) 960-0111 |
| Price:                           | \$1,295.00 for 256K;<br>\$1,445.00 for 1 MB  |

should be viewed with considerable trepidation by the less hardware conscious users... especially those who have purchased cheap clones that only just barely work at the best of times. An experienced friend would be a very handy installation tool.

## Management Skills

The advantages of true memory management will become apparent only as applications gain sophistication. For instance, the ALL memory manager will provide highly desirable features for multi-user operation, such as the protection of each program's memory space from others. It can allow operating systems to run in both system and user modes, with separate protection and mapping for each. It will also support virtual memory systems, by keeping track of RAM areas that have not been altered and hence don't need to be written to disk.

It's hard to predict how the ALL card is going to do in the real world. Undoubtedly, ALL has surpassed other memory expansion boards. While Lotus, Intel *et al* are attacking the memory problem on a minimalist basis, ALL has reached out for a final, elegant solution. Until processor chips themselves incorporate memory management, there should be a very good niche for ALL's approach. The system is not cheap, but it shouldn't be too hard to justify the extra expense if you really need the extra RAM space in the first place.

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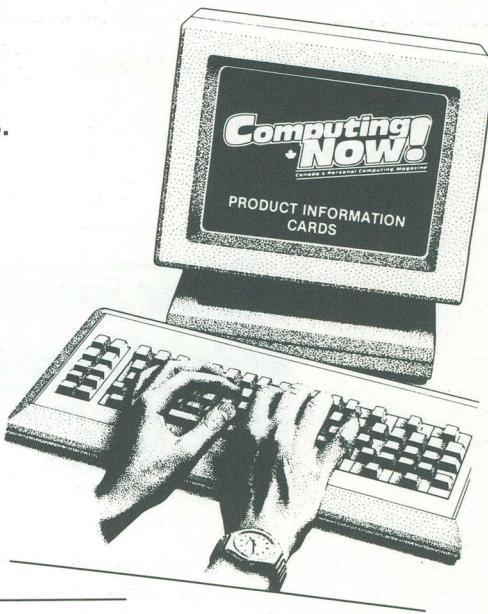
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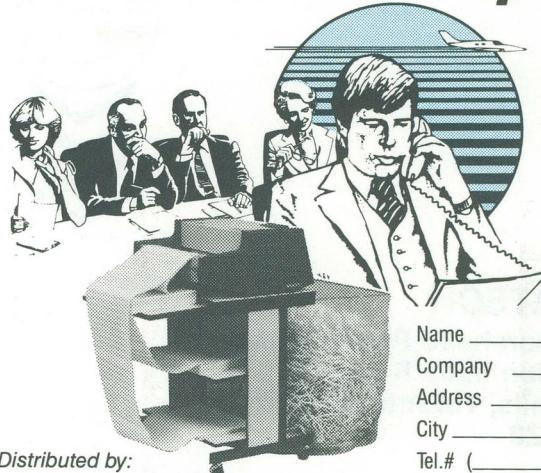
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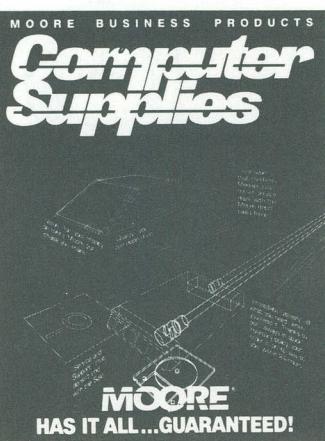
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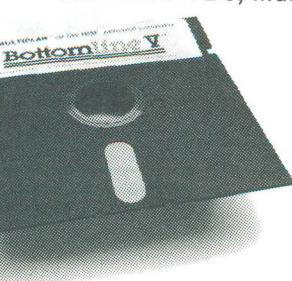
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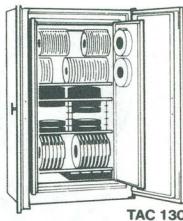
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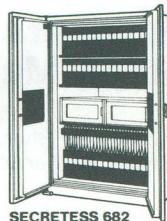
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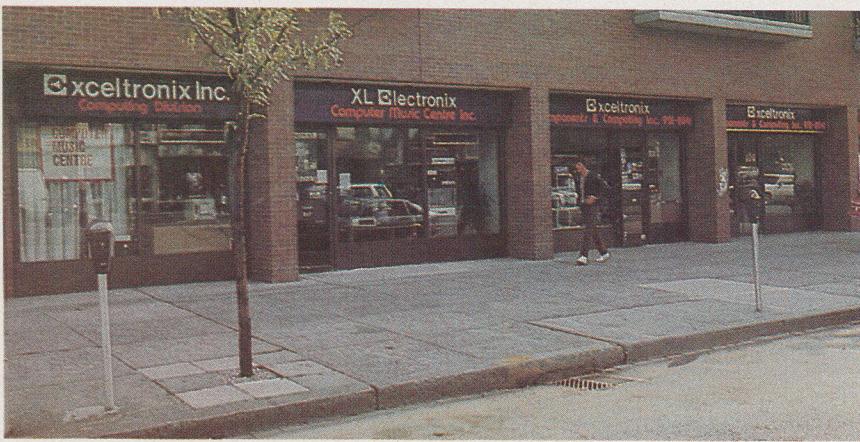
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# Exceltronix



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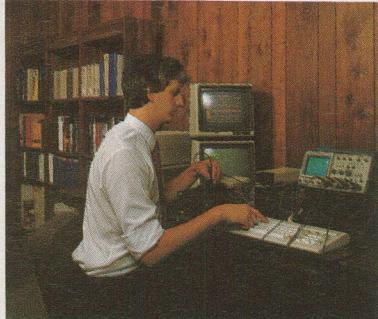


Multiflex and Versa-Digital developed and manufactured the digital display signs used on the Toronto Subway System and the Vancouver LRT Transit System — and they are now controlled and updated using several BEST computers!

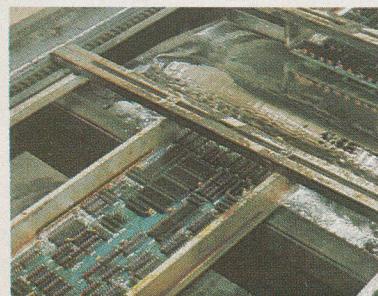


Our newly purchased 25,000 square feet facility, near Toronto airport, will allow us to expand research and development in the computer field.

It will also take us into a new field of development advanced underwater intelligent robotics.

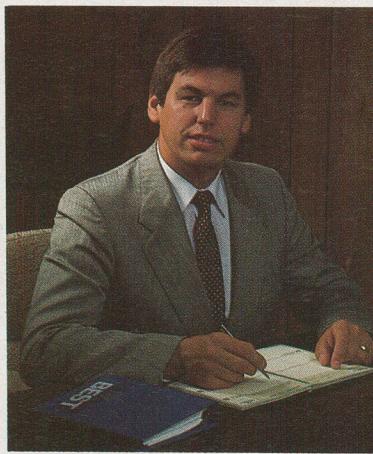


In excess of \$1 million was devoted by Multiflex to development of new high tech products in 1985.



All our own products are manufactured in Canada to the highest quality, including being flow-soldered and ultrasonically cleaned.

2 — Exceltronix Spring 1986 Catalogue



Eugen F. Hutka, the founder and President of Exceltronix, Multiflex and all the associated companies.

All prices and specifications in this catalogue are subject to change without notice.

Our cover shows our AVT-286, IBM AT compatible computer with a graph showing our rapid and sustained growth.

## The History and Development

of our successful and rapidly expanding All-Canadian company committed to high technology.

Now in its seventh year, Exceltronix and its associated companies, has grown from a single store, to three retail outlets, a large mail order division, and an ever expanding engineering and manufacturing facility with revenues for 1986 expected to exceed \$15 million.

Many of the products sold at our own retail outlets are manufactured by our associated company, Multiflex Inventions and Technology in Toronto. This direct link between manufacturing and retailing benefits our customers in several ways. Our competitive prices result from not having to deal with middlemen (with their markups) and enables us to respond rapidly to the changing needs of customers. We are proud of both the high quality of our products and their excellent reliability and consequently we are able to offer warranties far better than the industry standard. Exceltronix is probably most widely known for its highly successful line of IBM compatible BEST personal computers and peripherals, but when an off-the-shelf product will not satisfy your needs, the engineering division at Multiflex is able to analyze your problem and develop a cost effective solution. Proof of this is the Advanced Message Display System in the Toronto Subway System and the Vancouver LRT, manufactured by Versa-Digital, another associated company. These examples are just some of the many solutions that we have provided for Canadian industry and commerce and we will be happy to discuss your particular requirements.

Even though we have grown enormously, we have not lost the personal touch that contributed to that growth. Although we are now one of the largest manufacturers of computers in Canada, our dedicated and knowledgeable staff are happy to discuss your needs, be it for a computer to solve a problem or a single electronic component.

In the recent past, the microcomputer business has seen huge booms and some massive recessions. Despite this, Exceltronix and its associated companies have grown consistently and we continue to increase our market share. Being diversified, we have the resources to research and develop our products properly. Not being dependent on a single line, we have avoided the mistake of many computer companies of bringing out products before they are properly developed.

Our company is proud of the fast and excellent service in our stores and we now have available a team of specialists who can provide on-site analysis of your hardware, software and interfacing needs.

We have yet to see what tomorrow has to offer, but you can be assured that the Exceltronix group of companies will be accepting the challenge.

### Associated Companies:

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Toronto Computing Centre Inc.

Versa-Digital

Technology Inc.

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XL Electronix Computer

Music Centre Inc.

# BEST AVT-286: the IBM AT Compatible

## Designed and made in Canada with pride.

Proving once again that Multiflex is an industry leader, by producing more than just affordable alternatives in personal computer design, we are pleased to announce the **BEST AVT-286 Microcomputer, our new, fast IBM AT compatible.** The **AVT-286** is based on the 80286 microprocessor. The **AVT-286** is supported by the *Phoenix AT compatible Bios*, the same software house that supplies the Bios for all other **BEST** computers as well as many of the well known IBM compatibles currently manufactured.

Check the long list of standard features that are included on the new **BEST AVT-286**:

- The **AVT-286** runs faster than the (12MHz) IBM AT but retains superb software compatibility.
- The main board features a standard 640K RAM using state-of-the-art memory chips for fast, reliable data processing.
- **Seven expansion slots** of which five support IBM AT signals. The two remaining slots are compatible with IBM PC or XT peripheral boards.
- **Presocketed** for the optional 80287 math co-processor
- **Two floppy diskette drives**, one formatted for a capacity of **1.2 Megabytes**, the other for 360K to read and write normal diskettes.
- The **BEST Colour Video board** which offers the user four modes of operation, composite and RGB output.
- An **AT compatible keyboard**.
- On board **Real Time Clock/Calendar** with battery backup.
- **Parallel Port** (for printers etc.)
- **Serial Port** (for communications).

### The BEST AVT-286

Canadian designed and made, Super IBM AT compatibility, 640K RAM, Two 5.25in. Disk Drives (one high density 1.2Mb, one 360K), Serial and Parallel Ports, High quality keyboard, Keyboard lock and Status Panel. See detailed description above.  
Simpler or more complex configurations available at most competitive prices.

### The BEST IBM AT Compatible 4 Meg Memory Card

In order to take advantage of the memory addressing capabilities of the IBM AT or the **BEST AVT-286** business computer, we developed a memory card to give the user up to 4 Megabytes of dynamic RAM. The memory card will run at speeds up to 16MHz, which is fast enough to meet the needs of any 80286 microprocessor on the market today. The design uses state-of-the-art (256K x 9) memory arrays, to allow for maximum memory in the smallest physical space. The ninth bit is used as a parity bit to insure the validity of the data. The card is available in memory sizes from



- **Heavy duty Power Supply** as standard allows for adding extra cards as well as a Hard Disk without requiring an upgrade.
- Attractive **flip-top case**.
- A **keyboard lock** with unique security key which prevents any unauthorised use of the system.

- A **front control status panel** provides information on the keyboard lock status, reset, power-on, disk activity and parity errors.
- A **hardware reset button** so the system can restart without having to power down.

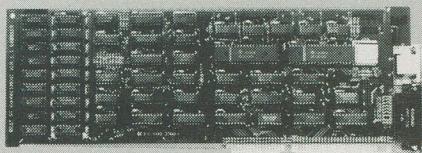
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### Warranty

We have such confidence in the time tested reliability of the **BEST** that we offer a 300 day warranty which is way above the industry standard. On-site service plan available at extra cost Nation-wide through 3M of Canada Ltd.



### Attention IBM Owners!

#### BEST AT Compatible Enhancement Card

This card includes the following features: Two Serial Communications Ports, One Parallel Printer Port and Memory starting from 128K to 512K in selectable boundaries. This card will allow IBM AT user with 256K or 512K of on-board memory to

expand that AT machine to full 640K capability as well as provide them with two serial ports and one parallel port.

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# SUPER-FAST BEST Mark IV

In today's industry, more than ever, time is money. It is for that reason we developed the **Mark IV** personal computer.

Still retaining IBM PC and XT software and hardware compatibility, the **Mark IV** uses the true 16-bit 8086-2 microprocessor. Although the system runs at the same clock speed as the **Mark III**, the 8086-2 has a 16-bit external data bus compared to the 8088 and 8088-2's 8-bit data bus. This allows memory access to occur **much faster** than with most other IBM PC/XT and compatible computers.

The bus structure of the **Mk IV** remains compatible with the standard IBM 8-bit I/O channel but still has the benefits of the 16-bit architecture.

Couple the 8086-2 microprocessor with the 8087 math co-processor and you have one of the fastest, most reliable business or engineering aids available in this price range.

Since the **BEST Mark IV** is geared towards the serious microcomputer user, a standard complement of 640K RAM is installed on the main board, along with a long list of standard features.

Made in Canada with pride.  
Superb IBM PC/XT Compatibility



## Standard Features of the **BEST Mk IV**

- Superb IBM Compatibility.
- Canadian made
- **Phoenix BIOS**, as used in many major brand IBM compatible systems.
- 640K of RAM Memory.
- Seven Expansion slots, so that you have lots of room to tailor the system to your needs, with the wide range of peripheral cards available.
- Real Time Clock/Calendar, with software and battery backup.
- Parallel Printer port, to interface dot matrix, letter quality printers and digital plotters.
- Serial Communications Port that supports all RS232-C signals (a second serial port can be added).
- Two double sided, double density 360K 5.25 inch floppy disk drives, with the option of adding an additional two drives.
- Colour graphics video board, with both RGB and composite video outputs. Four modes of operation are available with this board.
- Pre-socketed for the optional Intel 8087 math co-processor.
- A reset switch, which can be a life saver, in the event of a program hanging your system.

- A 150 watt power supply, with more than enough power to supply expansion boards, disk drives, and hard disk drives.
- IBM compatible, high quality keyboard.

## Warranty

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## SUPER-FAST **BEST MK IV**

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## The **BEST** line

ALL of the **BEST** personal computers come with standard features that other manufacturers consider expensive options. The excellent reliability proved since we started manufacturing this range enables us to offer warranties far, far better the industry standard.

A complete description of the personal computers manufactured is included in this catalogue. Before you buy your system our computer fluent sales staff can provide you with advice on the hardware and software required to solve your problem. And remember that after you purchase the **BEST** computer that suits your needs, **Exceltronix** and its sister companies will be around long after some other retailers have come and gone, to offer you unparalleled service and selection, as we have been for the last six years.

**Special Requirements?** We have the in-house experts in both hardware and software to interface a lot of complex equipment to IBM, **BEST** or compatible computers. We can recommend or customise existing software packages for your business or industrial needs. We have excellent in-store and on-the-road sales staff with computer expertise and a superb team of in-house hardware and software engineers.

We can probably help you with every aspect of your computer needs at reasonable, honest prices. Call us.

## APPROXIMATED SPEED COMPARISONS

For the speed comparison test a PL1 programmer was compiled on a 360K RAM disk, namely VDisk supplied on Dos 3.0. The reasons for this instead of a diskette are twofold: 1. The drive characteristics between an AT and a PC are radically different. We wouldn't know if we were comparing speed of the drives or speed of the machines. 2. The 16-bit machines such as the **Mark IV** and AT cannot utilize their full power while talking to 8-bit devices.

The base was an IBM PC/XT with 640K running at 4.77MHz. The compile was of moderate length: 170 seconds. The table here gives the results of the speed test:

| Machine Type   | IBM PC/XT | Mark III | Mark IV  | IBM PC/AT               | AVT-286                 |
|----------------|-----------|----------|----------|-------------------------|-------------------------|
| Seconds        | 4.77 MHz  | 8.00 MHz | 8.00 MHz | (12 MHz)<br>(6 MHz CPU) | (16 MHz)<br>(8 MHz CPU) |
| Relative Speed | 1.00      | 1.62     | 2.13     | 2.53                    | 3.2                     |

Looking at the table we see a number of remarkable things. The first is the speed of the AVT-286 over the IBM PC/AT. The AVT-286 is about 25% faster than the IBM AT! The other remarkable thing is that the **Mark IV** is only 16% slower than the IBM AT! (This is even more remarkable considering the price differential). We also see, as expected, that the 16 bit data path of the 8086 in the **Mark IV** gives 31% improvement over the **Mark III** at equivalent processor clock speeds.

## If you want the Best, buy the **BEST**

# We are proud to introduce the New FAST BEST Mark III

To meet the demanding needs of industry for faster information processing, Exceltronix is pleased and proud to introduce the Mark III personal computer. Based on the success of the BEST Mark II, the Mark III goes a step beyond. The system is based on the 8088-2 microprocessor, which is capable of running almost twice as fast as any 8088 based system.

- Superb IBM PC/XT software and hardware compatibility has been retained.
- A hardware switch allows you to go from 4.77MHz to 8MHz operation. Any software that implements a lot of memory manipulation will run visibly faster. Compilers work much faster, spreadsheets will speed through calculations, and even video intensive games run quicker.
- All the same cost effective package that made the Mark II a success, has been continued in the Mark III. We consider features such as a Real Time Clock, Parallel Printer Port, Serial Communications Port and a minimum of 256K RAM memory, necessities in today's personal computer. These have been included in the base price along with a colour video board, so even if you don't need the options today, tomorrow you will not have to pay to have them installed.

Made in Canada with pride.

## Superb IBM PC/XT Compatibility



Monitor and printer not included. IBM is a registered trade mark of IBM Canada Limited.

### The FAST BEST MK III

As BEST MK II plus speed selectable: 4.77 and 8MHz (most software will run on the higher speed), uses 8088-2 processor.

# \$1895<sup>00</sup>

#### Other Configurations:

|  |        |
|--|--------|
| With 640K RAM .....                        | \$1995 |
| With 10 Meg Hard Drive/1 Floppy/256K ..... | \$2795 |
| With 10 Meg Hard Drive/1 Floppy/640K ..... | \$2895 |
| With 20 Meg Hard Drive/1 Floppy/256K ..... | \$2895 |
| With 20 Meg Hard Drive/1 Floppy/640K ..... | \$2995 |

### Standard Features Common to the BEST MK II and MK III

- Superb IBM Compatibility.
- Phoenix BIOS, as used in many major brand IBM compatible systems.
- Minimum of 256K RAM (Random Access Memory) using 41256K RAM chips, expandable to 640K or higher on the main board.
- Seven Expansion slots
- Real Time Clock/Calendar, with software with battery backup.
- Parallel Printer port
- Serial Communications Port that supports all RS232-C signals (a second serial port can be added for only \$39.00 extra).

- Two double sided, double density 360K 5.25 inch floppy disk drives
- Colour graphics video board, with both RGB and composite video outputs.
- Pre-socketed for the optional Intel 8087 math co-processor
- A reset switch
- A 150 watt power supply, with more than enough power to supply expansion boards, disk drives, and hard disk drives.
- IBM compatible, high quality keyboard.

### Warranty

We have such confidence in the time tested reliability of the BEST that we offer a 300 day warranty which is way above the industry standard. Nation-wide on-site service plan available at extra cost through 3M of Canada Ltd.

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| Options:                            |             |
| Tape Drive .....                    | from \$1295 |
| Second Floppy on H.D. systems ..... | \$180       |
| Second Serial Port .....            | \$39        |

### The BEST Mark II

Made In Canada

### Superb IBM PC/XT Compatibility

In the past two years, thousands of BEST personal computers have been working their way into the Canadian business, educational and home environment. Based on the 8088 microprocessor, the BEST Mark II is an inexpensive entry into the personal computer field.

As with all the BEST product range, it is made in Canada to the highest standard of quality.

It is the success of the original BEST and the Mk II that prompted us to develop the newer and faster Mk III and Mk IV.



Monitor and printer not included. IBM is a registered trade mark of IBM Canada Limited.

### BEST MARK II

Standard Mark II with 256K RAM and two 360K DD/DS diskette drives, Serial and Parallel Ports, Real Time Clock, Phoenix BIOS. Uses 8088 processor.

# \$1695

If you want the Best, buy the BEST

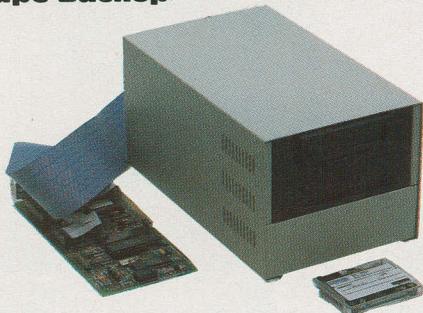
#### Other Configurations:

|  |        |
|--|--------|
| With 640K RAM .....                        | \$1795 |
| With 10 Meg Hard Drive/1 Floppy/256K ..... | \$2595 |
| With 10 Meg Hard Drive/1 Floppy/640K ..... | \$2695 |
| With 20 Meg Hard Drive/1 Floppy/256K ..... | \$2695 |
| With 20 Meg Hard Drive/1 Floppy/640K ..... | \$2795 |

## Upgrade your IBM

### BEST External Hard Disk Drive and Tape Back-up Unit

**Easily Convert your IBM PC or Compatible into a Hard Drive System with Tape Backup.**



As more people become educated in the use of personal computers, the office computer becomes victim to late night hackers and curiosity seekers. The data upon which your business decisions are made every day is in danger of being wiped away by a wrong sequence of key presses or the data may be seen by those without proper authorization. Protect your data and yourself by removing the hard disk drive from the system.

Multiflex has designed a unit which allows you to physically remove the mass data storage device and lock it in another room without disassembling your entire system. The external hard disk drive and tape backup unit is self contained with its own power supply and connects to back of your system through a ribbon cable. Simply follow normal shut down procedures then unplug the unit and carry it to a safe location.

**With Seagate 20 Megabyte Hard drive and Scorpion Tape Backup unit**  
**\$2795.00**

**With 10 Megabyte Hard Drive and Irwin Tape Backup unit**  
**\$2395.00**

**Convert your IBM PC or XT into a Hard Drive System within Minutes**  
**Do It yourself with no mechanical alterations.**



This unit rapidly converts your system into a Hard Drive unit, and it is compact enough to fit in a brief case. The unit contains its own power supply, fan, a reliable Seagate 20 Megabyte hard drive and a controller card which plugs into your existing system.

**With Seagate 20 Megabyte Hard Drive**  
**\$1295.00**

**With 10 Megabyte Hard Drive**  
**\$1195.00**

### BEST EXPANSION System for your IBM PC

If you are one of the many who invested thousands of dollars in an IBM PC, you may be realizing the limitations of the hardware you own. The power supply may not be able to handle the addition of a hard disk drive or the five expansion slots may already be filled with necessities, leaving no room for the luxuries of more memory or communications hardware.

The BEST Expansion System was designed to function in a transparent fashion to the IBM operating system. The host system (IBM PC or XT) will look at a peripheral card in any of the eight slots of the expansion system as if it were installed in the slots on its own main board.



The Expansion System is packaged in an attractive flip-top case with its own power supply and ventilation fan. Two 3 foot long ribbon cables connect the host computer to the expansion system, which allows the expansion system to be placed on top, beside or underneath of your existing IBM PC or XT system.

The expansion chassis is powered by a 150 watt power supply with power connectors for two disk drives included as a standard feature. This power supply has enough power to run four diskette drives, expansion cards, or hard disk drives.

Although the system provides you with more slots and the capacity for a hard drive, your existing system will run with less load and therefore cooler.

Complete BEST Expansion System including the peripheral adapter to plug into your existing IBM PC or XT system, 8-slot expansion bus, with flip-top case and 150W power supply and cooling fan.

**Price \$795.00**

### Add a Tape Drive to your Existing System

Those who have used computers for any length of time can explain the absolute necessity for an external backup of the data held in a Hard Disk. Our self-contained unit, including power supply, (which looks similar to the Hard Drive Unit illustrated left) has a cable and peripheral card which simply plugs into your IBM or compatible system.

Tapes for these systems are readily available.

**With Irwin Tape Drive and BEST Controller**  
**\$1195**

**With Scorpion Tape Drive and Controller**  
**\$1395**

### Add Extra 360K Disk Drives to your System

If you need more than the two existing drives for your system, our self-contained external unit with two 5.25in. 360K disk drives with its own power supply, fan and controller will be of interest.

**Price \$595.00**

## The BEST Colour Graphics Video Board



The BEST Colour Graphics Video Board was designed for those personal computer users who require an inexpensive, but versatile video display. The user has a choice of three types of monitors that can be connected to the card, a composite monochrome monitor, composite colour monitor or direct drive RGB colour monitor. Software utilizing a light pen can be run since the BEST-Colour Video board supports the necessary hardware.

The video board is capable of operating in four modes, two text and two modes of graphics display

### Text display

The BEST Video Card can display either 80 or 40 characters on one line. The character generator contains all the standard ASCII characters plus block graphic characters and a set of international characters such as the English pound and Japanese Yen. Depending on your choice of monitor, the application text can be displayed with a variety of foreground and background colours. In addition, black and white mode allows for the following attributes: reverse video, blinking and highlighting.

The operator can switch between 40 and 80 column display by using the DOS MODE command. The 80 column mode gives crisp characters on either colour or monochrome monitors. The 40 column text mode is suitable to use if you were to use a common television set in conjunction with a RF modulator that can be directly attached to the video board.

### Graphics Display

The BEST video board is capable of displaying three styles of graphics.

### Low resolution — Monochrome or Colour

In the low resolution mode either colour or monochrome graphics can be displayed. The screen is capable of displaying 200 rows of 320 pixels (a pixel is one dot on the screen). In the colour graphics mode each pixel can be one of four colours, and the background can be one of 16 colours. Many software packages are written with colour graphics capabilities. LOTUS 123, and Symphony for example become more powerful and easier to use with the addition of crisp and vivid colour graphics.

### High resolution — monochrome

For applications such as computerized drafting or intricate business charts, colour may not be desired, but high resolution is required. The BEST card is able to double the resolution of the display to 200 rows of 640 pixels, by selecting the monochrome instead of colour graphics. In the high resolution mode an inexpensive composite monitor can still be used.

**\$179.00 with Warranty**

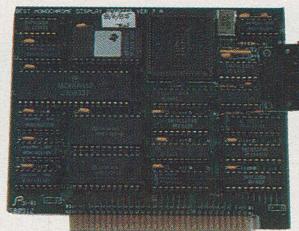
## BEST MODEM

The BEST modem is a smart 1200/300 direct connect modem. It can either be a stand-alone unit in which case it requires a small wall adaptor, or it plugs in one of the IBM slots. When used as a stand-alone unit, the modem looks like a Hayes 1200 Smart Modem, that is, it emulates the instruction set. When it is used in the IBM, it looks like an serial communications port which also supports a super-set of instruction set.

It supports auto-dial, auto-answer, and auto-speed select control. The modem also has a speaker so that

it is possible. There are also LED monitors so can always be known. These LEDs are: enabled, Carrier Detected, Transmitting,

## The BEST Monochrome Card



In the office environment where a great deal of word processing, or data entry takes place, eye fatigue may be a problem. A solution to this problem is an upgraded text display card for your BEST, IBM PC or compatible. The monochrome card displays a character that is made up of 7 x 9 matrix of dots in comparison to the 5 x 7 matrix used on the standard colour graphics video board. The finer dot pattern makes text appear much cleaner and easier to read. The monochrome card will display characters in four modes; normal, intensified, reverse video and blinking. The display is 80 x 25 characters. Note: This is a half size board which will fit even those computers with restricted space.

**\$179.00 with Warranty**

## Phoenix Video Board

The choice of a video display card can be a difficult one. There are many different capabilities for each style of video card available. If your display needs are as diverse as the number of cards available, you may have to install two or three video cards in your system. Not only is this expensive, but it also steals precious expansion slots from your system. Phoenix Computer corp. has designed an expansion card to satisfy all of your display needs. The Phoenix video card can emulate the following styles of display cards.

IBM colour graphics card — 40 or 80 column character display

320 x 200 colour graphics

640 x 200 monochrome graphics

IBM monochrome text display — 80 column high resolution text display

Techmar

Hercules high resolution monochrome graphics display 120 x 132 column colour text display mode

Depending on which display mode you choose any monitor up to 25kHz colour monitors can be interfaced to the Phoenix video card. The setup software is menu driven, and allows the user to program its own character set, as well as selecting from a 64 colour pallet.

**\$395.00 with Warranty**

## Hercules

Colour Graphics Board ..... \$312.00

4 colour graphics and printer board that fits into standard PC/XT or compatible slot. Also included is a parallel interface.

Monochrome Board ..... \$600.00

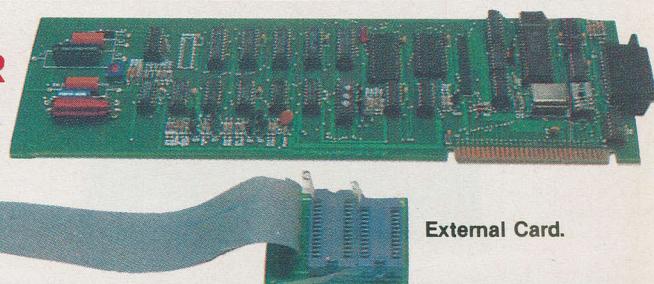
A high resolution monochrome display of graphics. Supports word processor, and business graphics software.

## Tecmar

Graphics Master Board/Paint ..... \$799.00

Displays alphanumeric text and graphics on any monochrome display or other standard composite or RGB monitors. Comes complete with a light pen and PC paint brush.

## EPROM PROGRAMMER



External Card.

This card can program any one of the following EPROMs: 2716, 2732, 2732A, 2764 and 27128s. Two sockets are available on the adaptor board, one for the 28-pin EPROMs, the other for 24-pin types. These sockets are standard sockets, however as an option ZIF sockets can be used (we recommend ZIF sockets if large numbers of EPROMs will be programmed). Also as an option an extension board is available. This board attaches to the adaptor via a ribbon cable and extends out the back panel. This is to allow EPROMs to be programmed without removing the cabinet cover every time programming is to be performed. Also as a standard feature, the source software is supplied to allow users to modify the program to suit their needs.

As an option a serial port can be included on the card; this serial port has the same features as the port described with the floppy disk controller (see the floppy disk description for documentation of the serial port).

### MAIN EPROM PROGRAMMER CARD (WITH SOFTWARE)

With 2 standard EPROM sockets ..... \$99.00

### EPROM PROGRAMMER WITH ZIF SOCKETS (WITH SOFTWARE)

With one 24-pin, ZIF socket and one 28-pin ZIF socket with provision for serial port ..... \$139.00

### EXTERNAL CARD

Ready to plug into the main EPROM Card (includes one 24-pin and 28-pin ZIF socket and cable). Saves you from opening the computer each time you want to program your EPROMS. .... \$69.00

### SERIAL OPTION

For your main EPROM programmer. Provides you with a second RS232 serial port ..... \$49.00

Receiving, Data Set ready.

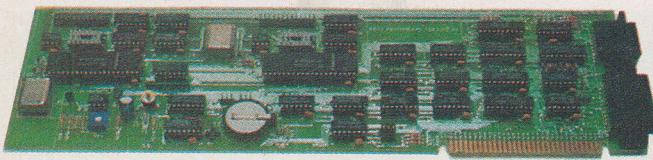
Software packages such as Crosstalk, PC-talk, and Hayes' Smart-com II also will run with this modem.



300 Baud **\$179.00** 300/1200 Baud **\$249.00**

300/1200 Baud, Stand-Alone Unit, Attractively Packaged ..... **\$299.00**

## The BEST Quanta Board



Do you find that your PC is not able to communicate with the outside world and you are constantly having to tell it the correct time and date? A simple solution for a system's short coming would be the BEST Quanta Board. Another of the multi-function boards designed with the personal computer user in mind, its features include the following:

### Serial Ports

- Two serial communication ports that are configured under PC or MS-DOS as COM1 or COM2. Both communications ports support RS232-C signals (Tx, Rx, DTR, DSR, RTS, CTS, CD, and RI) at communication rates of up to 9600 Baud. One or both the serial ports can be disabled, to alleviate contention between any other serial port your system may already contain. The serial ports can also be configured to support the IBM PC mA current loop. The current loop allows the system to communicate with some types of teletype printers.

### Parallel Printer Port

- A parallel printer port which supports many of the popular dot matrix and letter quality printers, as well as digital plotters that are commercially available. The parallel port can be selected as the primary or secondary printer port (LPT2 or LPT3 using DIP switches).

### Games Port

- A game port which allows up to four game paddles, or two joy sticks to be connected to the system. The port is not limited to entertainment software. The port actually gives a value proportional to the resistance on the input, which allows your system to control industrial applications and CAD (computer aided design) software.

### Real Time Clock/Calendar

- A real time clock/calendar with software to interface the clock hardware with the TIME and DATE functions of MS-DOS and PC-DOS. The clock continues to keep the correct time when the system is powered down by utilizing a replaceable lithium battery. The clock is based on the MM58274 CMOS chip and it is accurate to within seconds every year.

**\$159.00 Cables Extra.**

## BEST Multi-Function Disk Drive Controller



The BEST Multi-Function disk drive controller is much more than its name implies. This card makes the most use of an expansion slot in your system by including many needed options on one card. This board may be the last you will have to install in your IBM PC or compatible system because of the extra features we have included.

### Floppy Controller

- Floppy disk drive controller, which can handle up to four double sided, double density 5.25in. 360K disk drives.

The controller circuitry will also control some Tape Back Up units such as those manufactured by Irwin Magnetics in place of one of the four disk drives.

### Serial Ports

- Two serial communications ports that support RS232-C standard signals (Tx, Rx, DTR, DSR, RTS, CTS, and RI).

### Parallel Printer Port

- Parallel Printer Port that can be configured as either your primary or secondary printer port.

### Real Time Clock/Calendar

- Real Time Clock with software, to integrate the clock with your version of PC-DOS or MS-DOS. The clock is designed around an ICL clock chip and is accurate to within seconds a year. A battery back up continues to keep the time during power down.

This is the same floppy controller used in all versions of the BEST personal computer, with excellent reliability and compatibility. Using PC-DOS 2.0 or later, each diskette has a formatted capacity of 360 Kilobytes.

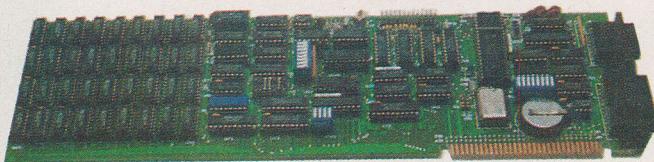
**\$199.00**

## The BEST Economy Floppy Controller

If all you need is an IBM Floppy Controller for your IBM or compatible 360K DS/DD disk drives, we have an economy BEST Floppy Controller which does not have provision for the extra features described in the Multi-Function Disk Drive Controller.

**\$99.00**

## The BEST 256K/512K PentaRAM Board



Almost every option your system is lacking can be supplied by the BEST PentaRAM board. This combination of options is one of the most economical ways (from the point of view of both your pocketbook and the expansion slots on your system) to expand your system. All communication ports follow the industry standards. The additional memory continues from where your main board's memory stopped, in a completely transparent fashion. In detail the features of the BEST PentaRAM board are as follows:

### Memory

- Up to 256K RAM using 4164's or 512K RAM using state-of-the-art 41256's can be added to your system. The starting memory boundary can be set to 256K, 384K, 512K, or 640K by configuring a bank of dip switches. The added memory is necessary for anyone wishing to operate a RAMdisk, and much of today's software requires a minimum of 384K RAM (Symphony, Framework, etc.) which many of the older PC's are not capable of holding on the main board. Each bank of memory contains an extra chip to support a parity bit for reliable data handling. (If the above boundaries do not match your system's configuration, they can be modified at the factory).

### Serial Port

- A serial communication port that is configured under PC-DOS or MS-DOS as COM1 or COM2. The communications port supports RS232-C signals (Tx, Rx, DTR, DSR, RTS, CTS, CD, and RI) at communication rates of up to 9600 Baud. The serial port can be disabled, to alleviate contention between any other serial port your system may already contain. The serial port can also be configured to support the IBM PC mA current loop. The current loop allows the system to communicate with some types of teletype printers.

### Parallel Printer Port

- A parallel printer port which supports many of the popular dot matrix and letter quality printers, as well as digital plotters that are commercially available. The parallel port can be selected as the primary or secondary printer port (LPT2 or LPT3 using DIP switches).

### Games Port

- A game port which allows up to four game paddles, or two joy sticks to be connected to the system. The port is not limited to entertainment software. The port actually gives a value proportional to the resistance on the input, which allows your system to control industrial applications and CAD (computer aided design) software.

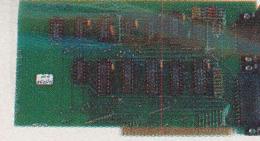
### Real Time Clock/Calendar

- A real time clock/calendar with software to interface the clock hardware with the TIME and DATE functions of MS-DOS and PC-DOS. The clock continues to keep the correct time when the system is powered down by utilizing a replaceable lithium battery. The clock is based on the MM58274 CMOS chip and it is accurate to within seconds every year.

**PentaRAM Board with 256K and all options  
\$299.00**

**PentaRAM Board with 512K and all options  
\$379.00**

## The BEST Parallel/ Game Card



**\$69.00 (Cables Extra)**

The BEST parallel/game card is an inexpensive addition to any BEST, IBM PC or compatible, which gives you the ability to connect almost any parallel printer or plotter to your system. The Parallel port is accessible through a DB25 connector located on the back of the card, which eliminates the need to disassemble the system case to connect the Interface cable to the card. Printers such as the Epson family and Star Micronics, Toshiba and others work with the BEST printer card with no special hardware except the connecting cable.

The game port is compatible with game paddles. Up to four game paddles or two joysticks can be connected via a 15-pin connector on the back of the card.

## BEST 512K RAM Board

Switch selectable boundaries

**Complete with 512K-\$299.00  
With 64K-\$169.00**

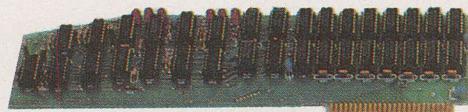
## BEST PROTOTYPING BOA

Mail Orders: 319 College Street, Toronto, Ontario, M5T 1S2

# Apple Compatible Products

## MULTIFLEX 128K MEMORY CARD . . . \$99.00 (with 128K of RAM on board)

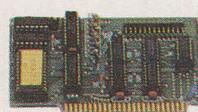
128K Card can be used to function as RAM disk with your Apple.



128K RAM Card

## MULTIFLEX PARALLEL PRINTER INTERFACE CARD WITH CABLE \$69.00

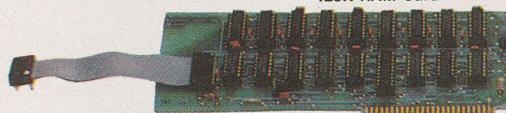
This card plugs into any of the Apple II+, IIe, or work-alike computers, and provides the user with a parallel interface capable of handling graphics and characters. Ideal for use with the Star Gemini and Epson Printers.



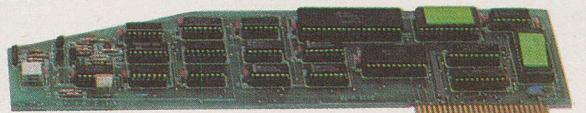
Parallel Printer Card



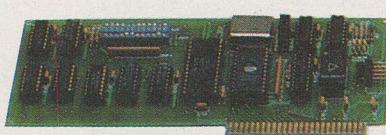
Z80/64K Card



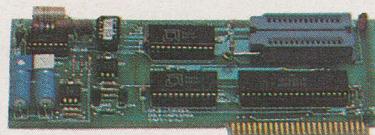
16K RAM Card



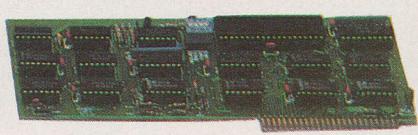
80 x 24 Card



Serial Card



EPROM Programmer



Z80 Card

## MULTIFLEX SUPER SERIAL CARD . . . \$89.00

This card allows you to: • select desired baud rate • connect to a serial RS-232 modem, terminal, or a serial printer port • for example, connect two Apple computers (using this card) to communicate with each other, through the RS-232 link over hundreds of feet.

## MULTIFLEX NEW SUPER 80 X 24 VIDEO CARD WITH SOFTSWITCH \$89.00

This new Multiflex card features: • superb 80 columns by 24 lines display, with upper and lower case, reverse video • includes built-in soft switch, allowing you to switch between the Apple's 40 column and the video cards 80 column from the keyboard. • superb compatibility.

## WIZARD IPI INTERFACE \$69.00

### 6502 Style Case

## 6502 Power Supply

CSA Approved,  
5V 5A, 12V 2.5A,  
-5V 0.5A -12V 0.5A  
\$69.00



With Numeric Keypad  
\$129.00

## MICROTEK SERIAL CARD FOR THE APPLE . . \$139.00

Similar functions to MULTIFLEX super serial card.

## MULTIFLEX EPROM PRO- GRAMMER . . . \$89.00

Features:  
• Eprom programmer for Apple computers • Programs 2716, 2732, 2732A, 2764 • ZIF socket for the EPROM • Complete with software • Comes with a built-in programming voltage supply.

Included with the card is a disk full of software, which using menus allows the user to program or verify EPROMS, check if they are blank, set pointers anywhere in memory, and save or load memory ranges to/from the disk drive, making this unit a very versatile piece of hardware for the hardware developer or hobbyist.

## MULTIFLEX 16K RAM CARD . . . . . \$59.00

Expand your 48K Apple II+ to 64K. The Multiflex 16K Ram Card allows other languages to be loaded into your Apple from disk or tape.

## MULTIFLEX Z80-64K CARD

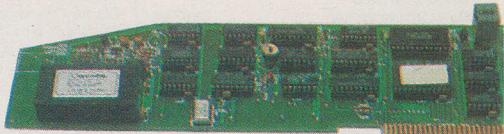
This spectacular card provides you with the functions of a Z80 card along with giving you extra 64K of self contained memory, on top of the existing memory in your Apple computer. (Software not included)

**\$179.00**

## MULTIFLEX UPGRADED Z80 CARD . . . . \$59.00

This card allows the user to run Z80/8080 programs on his Apple II+ or IIe computer. Specifically, it allows him to run the CP/M operating system with all its attendant software such as word processors, accounting packages, etc. (CP/M software not included).

## MULTIFLEX APPLE COMPATIBLE MODEM



Plugs into your Apple or compatible computer, Direct connect, 300 Baud, Autodial, Autoanswer, Touch Tone/Pulse Dial, complete with documentation.

**\$169.00**

Apple is a registered trade mark of Apple Canada Inc.

## APPLE COMPATIBLE DISK DRIVES

**\$199.00**

for Apple  
II+ and IIe

Now available  
for Apple IIC

**\$229.00**

Features:  
• Apple compatible • Attractively packaged • Professionally built and tested • Canadian Made • We believe that Multiflex put out more drives in the last year than all other Canadian manufacturers combined.

## SLIMLINE DISK DRIVE

**\$179.00**

Attractively packaged, Apple compatible, ultra reliable (90 day warranty).

Exceltronix Spring 1986 Catalogue — 9

# Exceltronix

Toronto Store: (416) 921-8941; Ottawa Store: (613) 230-9000

## IBM Compatible Software and Books



### ACCOUNTING

|                         |          |
|-------------------------|----------|
| BPI                     |          |
| Accounts Payable        | \$654.72 |
| Accounts Receivable     | \$654.72 |
| Information Management  | \$467.67 |
| Inventory Con/Gen Acct. | \$874.80 |
| Job Cost                | \$874.80 |
| Payroll                 | \$654.72 |

### DATABASES INTEGRATED

|                              |          |
|------------------------------|----------|
| ASHTON TATE                  |          |
| DBase III IV-1               | \$688.31 |
| Framework overhead exp. bnd. | \$668.25 |
| Friday                       | \$291.33 |
| Dbase Upgrade                | \$CALL   |

### MICROPRO

|                       |            |
|-----------------------|------------|
| Wordstar 2000 +       | \$1,099.60 |
| Wordstar Professional | \$638.23   |

### STONEWARE

|                   |          |
|-------------------|----------|
| Advance DB Master | \$654.72 |
|-------------------|----------|

### DATABASE - NON INTEGRATED

|            |          |
|------------|----------|
| SORCIM     |          |
| Easy Filer | \$440.15 |

### THORN EMI

|                 |          |
|-----------------|----------|
| Perfect Library | \$546.89 |
|-----------------|----------|

### TIMEWORK

|                |         |
|----------------|---------|
| Data Manager 3 | \$98.96 |
|----------------|---------|

### FILING

|                     |          |
|---------------------|----------|
| SOFTWARE PUBLISHING |          |
| PSF File            | \$154.09 |
| PSF Report          | \$137.55 |
| PFS Write           | \$154.05 |
| PSF Proof           | \$104.54 |

### SPREADSHEETS

|           |        |
|-----------|--------|
| LOTUS     |        |
| Lotus 123 | \$CALL |
| Symphony  | \$CALL |

### WORD PROCESSORS

|                    |         |
|--------------------|---------|
| BRODERBUND         |         |
| Bank Street Writer | \$87.98 |

### HAYDEN

|                            |         |
|----------------------------|---------|
| Business Program Portfolio | \$43.96 |
|----------------------------|---------|

### LIFETREE

|                        |          |
|------------------------|----------|
| Volkswriter Delux      | \$282.15 |
| Volkswriter Scientific | \$489.54 |

### MICROPRO

|                           |          |
|---------------------------|----------|
| Wordstar                  | \$324.47 |
| Wordstar 2000             | \$455.68 |
| Wordstar 2000 Upgrade Kit | \$456.38 |

### MULTIMATE

|           |          |
|-----------|----------|
| Multimate | \$391.77 |
|-----------|----------|

### SATELLITE

|                     |          |
|---------------------|----------|
| Word Perfect        | \$420.00 |
| Word Perfect Sorter | \$87.18  |

### MICROSOFT

|      |          |
|------|----------|
| Word | \$214.57 |
|------|----------|

### GRAPHICS APPLICATIONS

|              |          |
|--------------|----------|
| FOX & GELLER |          |
| Dgraph III   | \$272.28 |

### SOFTWARE PUBLISHING

|           |          |
|-----------|----------|
| PFS Graph | \$154.05 |
|-----------|----------|

### UNISON ADVANCED PRODUCTS

|              |         |
|--------------|---------|
| Print Master | \$65.96 |
|--------------|---------|

### COMMUNICATIONS TERMINAL PACKAGE

|           |  |
|-----------|--|
| MICROSOFT |  |
|-----------|--|

|                  |          |
|------------------|----------|
| Microsoft Access | \$275.10 |
|------------------|----------|

### MICROSTUFF

|               |          |
|---------------|----------|
| Crosstalk XVI | \$177.05 |
|---------------|----------|

### SOFTWARE PUBLISHING

|            |          |
|------------|----------|
| PFS Access | \$104.54 |
|------------|----------|

### THORN EMI

|              |          |
|--------------|----------|
| Perfect Link | \$141.95 |
|--------------|----------|

### PROGRAMMING AIDS

#### BORLAND

|                     |          |
|---------------------|----------|
| Turbo Pascal        | \$76.98  |
| Turbo Pascal MS DOS | \$76.98  |
| Generic             | \$76.98  |
| Turbo Pascal W/8087 | \$120.93 |
| Turbo Tutor         | \$38.46  |

### DIGITAL RESEARCH

|                       |          |
|-----------------------|----------|
| CBasic 86             | \$220.08 |
| CIS COBOL for CP/M 86 | \$93.33  |
| DR LOGO               | \$165.00 |
| Personal Basic        | \$165.06 |
| PL/I                  | \$825.28 |

### HOLT RHINEHART WINSTON

|                          |         |
|--------------------------|---------|
| Programming IBM PC BASIC | \$43.96 |
|--------------------------|---------|

### PROGRAMMING LANGUAGES

|                   |          |
|-------------------|----------|
| DIGITAL RESEARCH  |          |
| Concurrent PC DOS | \$324.61 |

|         |         |
|---------|---------|
| CP/M 86 | \$66.03 |
|---------|---------|

### R BRANDY/PRENTICE HALL

|                    |         |
|--------------------|---------|
| Pascal programming | \$71.44 |
|--------------------|---------|

### UTILITIES

#### ASHTON TATE

|              |          |
|--------------|----------|
| Framework II | \$688.31 |
|--------------|----------|

### BORLAND

|                          |          |
|--------------------------|----------|
| Sidekick Unprotected     | \$93.47  |
| Super Key                | \$76.98  |
| Turbo Graphics Toolbox   | \$60.47  |
| Turbo Game Words         | \$76.98  |
| Reflex                   | \$101.97 |
| Super Key/Sidekick Promo | \$852.09 |
| Turbo Holiday Pack #1    | \$137.55 |
| Turbo Toolbox            | \$60.47  |

### DIGITAL RESEARCH

|                    |          |
|--------------------|----------|
| Access Manager     | \$440.15 |
| Animator (3103-AA) | \$880.31 |
| C Compiler         | \$385.43 |

|                     |          |
|---------------------|----------|
| CBASIC COMPILER C86 | \$660.23 |
|---------------------|----------|

|                    |          |
|--------------------|----------|
| Display Manager 86 | \$550.19 |
|--------------------|----------|

|                    |          |
|--------------------|----------|
| DR Graph (5017-AA) | \$214.57 |
|--------------------|----------|

|                   |          |
|-------------------|----------|
| Forms 2 (3104-AA) | \$220.08 |
|-------------------|----------|

|                      |  |
|----------------------|--|
| Dr Assembler + tools |  |
|----------------------|--|

|        |          |
|--------|----------|
| cpm/86 | \$222.75 |
|--------|----------|

### MICROSOFT

|                          |          |
|--------------------------|----------|
| Macro Assembler          | \$165.06 |
| Microsoft Mouse (bus)    | \$220.87 |
| Microsoft Mouse (serial) | \$247.01 |
| Windows                  | \$107.65 |

### ROSESOFT

|            |        |
|------------|--------|
| Prokey 3.0 | \$CALL |
|------------|--------|

### SOFTWARE RESEARCH TECH

|                          |          |
|--------------------------|----------|
| Smart Key II Plus MS DOS | \$109.96 |
|--------------------------|----------|

### AUTOCAD SOFTWARE

|                             |          |
|-----------------------------|----------|
| Autocad 2 w/ ext's 1 & 2    | \$275.00 |
| Autocad 2 w/ ext's 1, 2 & 3 | \$342.00 |
| Autocad 2 (main module)     | \$137.50 |
| Extension 3                 | \$695.00 |

|                         |           |
|-------------------------|-----------|
| Acad 2 arch. & engineer | \$1375.00 |
|-------------------------|-----------|

### ENTERTAINMENT

#### INFOCOM

|          |         |
|----------|---------|
| Zork I   | \$43.96 |
| Zork II  | \$49.46 |
| Zork III | \$49.46 |

### SIMON & SCHUSTER

|            |         |
|------------|---------|
| Frogger II | \$38.45 |
|------------|---------|

|              |         |
|--------------|---------|
| Super ZAXXON | \$38.45 |
|--------------|---------|

### MICROSOFT

|                  |         |
|------------------|---------|
| Flight Simulator | \$54.96 |
|------------------|---------|

### SUBLOGIC

</

## New from Star Micronics



### SG-10 Printer

#### Ideal for Text & Graphics

- Dual Mode - NLQ/draft standard (NLQ = near letter quality) • 120 CPS and 20% faster throughput • Bidirectional, logic-seeking • 2K buffer (expandable to 6K with optional buffer interface) • 100% IBM PC or Star standard control codes switch selected • Friction and tractor standard • full 1 year warranty • 10" wide carriage • Standard parallel interface (serial optional) . . . . . \$379.00
- SG-10C for Commodore . . . . . \$399.00  
(No interface required)

### SG-10 C For Commodore Computers

All the same features as the SG-10 but includes built-in interface which plugs directly into Commodore computers.

**\$389.00**

### SR-15

- 200 cps and 20% faster throughput • IBM PC or Star standard control codes switch selected
- Dual Mode - NLQ/draft standard • Friction/tractor and automatic single sheet feed - standard • 15" carriage • 16K buffer • Bidirectional, logic seeking • Price/performance leader
- Parallel port standard, serial optional • Full 1 year warranty. . . . . \$995.00

## Toshiba Printers

### P321

Impact Wire Dot Matrix, 24-pin overlapping. Letter quality 72 c.p.s.; Draft quality 216 c.p.s. (12 cpi), 180 c.p.s. (10 cpi). Accepts Font Cartridges and downloadable font disks, Qume Sprint 11 emulation, 4" to 11" paper widths, PC compatible and more.

**\$1079.00**

### P351



Impact wire dot matrix, 24-pin overlapping. 4" to 15" paper width.

Accepts font cartridges and downloadable font disks, Qume Sprint 11 emulation, IBM PC compatibility, and more.

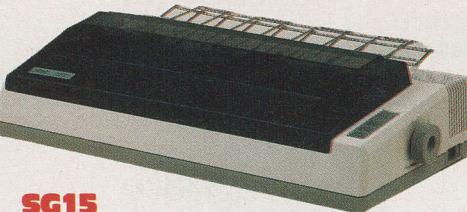
- Letter quality at 100 cps
- High-speed drafts at 288 cps
- Superb graphics at 360 x 180 and 180 x 180 dots per inch.

**\$1995.00**

## Epson

|                   |           |
|-------------------|-----------|
| FX 85 . . . . .   | \$649.00  |
| FX 286 . . . . .  | \$1129.00 |
| LQ1000 . . . . .  | \$1495.00 |
| CR 420 . . . . .  | \$5499.00 |
| SQ 2000 . . . . . | \$3099.00 |

## Star Micronics



### SG15

Same as SG10 except with 15" carriage and standard 16K buffer . . . . . \$599.00

### Radix

- 15" 200 cps, 100% duty cycle • 16K buffer
- serial & parallel standard • proportional & downloadable characters • 240 x 144 Ultra High Res. • tractor & friction...
- Radix 15 PC (for IBM PC) . . . . . \$995.00

## Star Printer Accessories

|  |         |
|--|---------|
| Printhead . . . . .                    | \$80.00 |
| Printwheel . . . . .                   | \$18.00 |
| Ribbons . . . . .                      | \$4.50  |
| Paper (500 sheets) (8½x11) . . . . .   | \$9.95  |
| Paper (2,000 sheets) (8½x11) . . . . . | \$32.00 |
| Dust covers . . . . .                  | \$8.50  |
| Printer Stand (plastic) 10" . . . . .  | \$34.00 |
| Printer Stand (plastic) 15" . . . . .  | \$38.00 |

### NEW NB-15 . . . . . \$CALL

- Impeccable letter quality at 100 c.p.s!
- 24 pin Dot Matrix • Letter Quality 100 c.p.s. (12 cpi) • Draft quality 300 c.p.s. • Optional Character Font cartridges • Optional sheet feeder • 4"-15" paper widths • IBM compatible.

### Copal

**SC5500I** 180cps, 132 column    **\$699.00**



**Copal SC1500T** . . . . . **\$499.00**

180 cps, 80 column

**Copal SC1200L** . . . . . **\$329.00**

120 cps, 80 column

## Cable Assemblies



**DB25 Male to DB25 Female** . . . . . \$35.00

**RS232 Cable (6ft of round conductor)** . . . . . \$39.00

RS232 other lengths and connector configurations available on request.

Parallel cable 36 pin Centronics type connectors, male joined by 6ft of ribbon cable to female . . . . . \$35.00

Parallel Cable for IBM interface DB25 through 6ft of ribbon to 36 pin centronics with appropriate connections . . . . . \$35.00

Cable Assemblies for two 5-1/4in drives and controller (e.g. IBM) using three 34 pin connectors and appropriate length of 34 conductor cable . . . . . \$35.00

20 pin Female header 24in. to 20 pin for Apple drives . . . . . \$6.95

## Star Micronics — Power Type daisywheel printer Letter Quality

**\$535.00**



**Print Speed:** 18 c.p.s. bi-directional, logic seeking

**Interface:** standard parallel (Centronics compatible) and serial RS232C-20mA current loop

**Paper Slew Speed:** 12 l.p.s. @ 1/6" spacing

**Print Buffer:** One line

**Print Size:** 10,12, 15 c.p.i and proportional spacing

**Number of Columns:** 110,132, 165

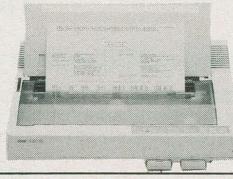
**Character Sets:** over 100 Type fonts available.

**Special Features:** proportional spacing; dual interface; standard printer mode and word processing mode; 32 easy access format switches reverse paper feed; short form tear-off;

**Line Spacing:** 3,4,6,8 lines/inch; switch and software selectable

**Paper Handling:** single sheet: 5.5" to 8.5" wide; sprocket 4" to 13" wide; copies 3 carbonless sheets

**Ribbon standard cassette**



**Okiidata ML192** . . . . . **\$699.00**

(Apple Imagewriter or compatible, IIe, IIC, Mac)  
• 120 cps • 2K Buffer, Serial Int., upgradeable to 10K  
• Tractor and friction • 10" • 19.2K Baud max. • Cable extra.

**Okiidata ML192 (IBM)** . . . . . **\$679.00**

• 160 cps • Parallel (optional Serial) • Correspondance quality • 10".

**Okiidata ML193** . . . . . **\$1089.00**

(Apple Imagewriter compatible IIe, IIC, Mac)  
• 120 cps • 2K Buffer, Serial Int., upgradeable to 10K  
• Tractor and friction • 15" • 19.2K Baud max. • Cable extra.

**Okiidata ML193 (IBM)** . . . . . **\$1069.00**

• 160 cps • Parallel (optional Serial) • Correspondance quality • 15".

## Serial Switch Box . . . \$59.00



Contains 3 RS232 connectors and a switch which switches all lines between input and one of two outputs.

# Monitors and Disk Drives

## Zenith Data Systems



**NEW**

### ZVM1220A

12in. diagonal screen • non-glare amber display  
• composite input • 25 lines x 40/80 characters  
**\$135.00**

**NEW**

### ZVM1230A

12in. diagonal screen • non-glare green display  
• composite input • 25 lines x 40/80 characters  
**\$135.00**

**NEW ZVM 1240** • 12" diagonal screen •  
glare amber display • PC monochrome input  
(TTL) • 25 lines x 80 characters • 720 x 350  
pixels • IBM PC & compatibles  
**\$229.00**

## NEW ZENITH COLOUR MONITORS

**NEW ZVM 1330** • 13" diagonal screen •  
input • 25 lines x 80 characters • 640 x 240  
pixels • green screen only switch • 16 colours  
including PC brown •  
**\$799.00**

**NEW ZVM 1350** • 13" diagonal screen •  
RGB/composite inputs • 25 lines x 80  
characters • 640 x 240 pixels • sound capability  
• green screen only switch • video "loop thru" feature •  
**\$839.00**

**CV-2560** • 25" diagonal screen • RGB/com-  
posite input • 25 lines x 80 characters • sound  
capability • green screen only switch • video  
"loop thru" feature  
**\$1049.00**

**ZVM 136** • 13" diagonal screen • RGB input •  
25 lines x 80 characters • 640 x 480 pixels •  
long persistence phosphors for interlaced ap-  
plications •  
**\$1195.00**

## Amdek Monitors

300A • 12in amber composite • 40-132 character  
display ..... **\$218.00**  
310A • 12in amber TTL • 40-132 character  
display ..... **\$229.00**  
700 Ultra high resolution ..... **Scall**

## Princeton Graphics Monitors

HX-12 12in 15MHz RGB high resolution, horizontal  
resolution 690 dots, vertical 240 lines (non-  
interlaced) 480 lines (interlaced) ..... **\$1199.00**  
SR-12 12in, 30MHz RGB ultra high resolution,  
horizontal resolution 690 dots, vertical 400-480  
lines (non-interlaced) ..... **\$1249.00**

**NEC Monitors now available — Call  
for price**

## Irwin 10 Meg Tape Drive Backup

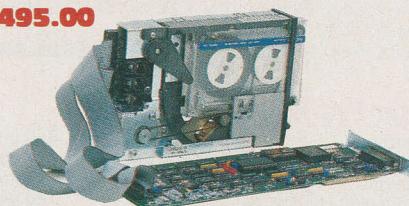
**\$1199.00**



Hooks up to your  
existing floppy  
controller.

## Scorpion 20 Meg Tape Drive Backup and Controller.

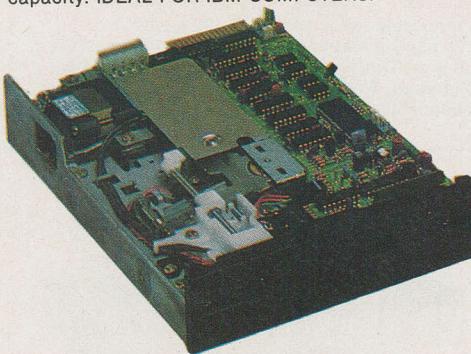
**\$1495.00**



## 5.25in. Disk Drives

**SA455** ..... **\$169.00**

• Shugart/Panasonic 5.25in. slimline, double sided,  
double density disk drive with 360K storage  
capacity. IDEAL FOR IBM COMPUTERS.



## Toshiba Disk Drives

**ND-04D 360K DS/DD  
(black or grey)** ..... **\$169.00**

**ND-08DE-G 1.2Mbyte AT Compatible,  
Grey** ..... **\$269.00**

Prices and specifications subject to change without  
notice.

## Hard Disk Drives

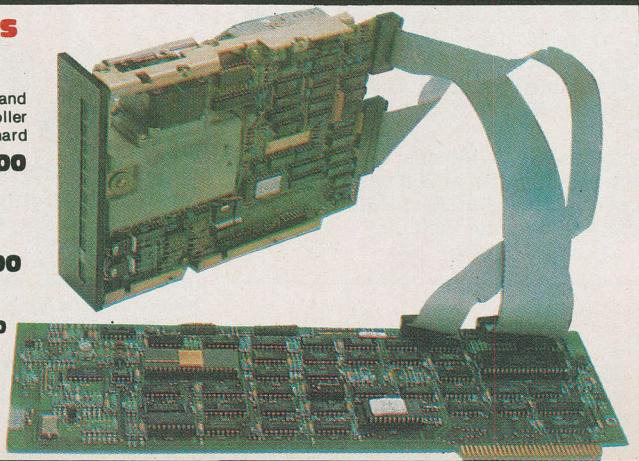
10 MEG Seagate, slimline drive and  
hard disk controller. This controller  
can handle up to two 10 MEG hard  
drives.

**\$895.00**

Seagate 20 MEG. with  
controller ..... **\$995.00**

Cables (for 10 or 20 MEG) **\$18.00**

Quantity discounts  
available on two or more



## Diskettes

### Prices per box of 10

10% discount on 3 or more boxes.

|                        |            |
|------------------------|------------|
| Dysan DS/DD .....      | \$35.95/10 |
| Dysan SS/DD .....      | \$27.50/10 |
| Maxell DS/DD .....     | \$35.95/10 |
| Maxell SS/DD .....     | \$28.95/10 |
| Exeltronix DS/DD ..... | \$24.95/10 |
| BASF DS/DD .....       | \$29.95/10 |
| BASF SS/DD .....       | \$22.95/10 |
| Pinnacle DS/DD .....   | \$21.95/10 |
| Pinnacle SS/DD .....   | \$16.50/10 |
| Elephant DS/DD .....   | \$24.95/10 |

## Modems

### Anchor Automation

Singleman 1200  
300/1200 baud smart modem ..... \$469.00  
Volks Modem (300-1200) ..... \$399.00

### Hayes

1200B Modem (stand alone) ..... \$605.00  
1200 Modem ..... \$620.00  
300 Modem ..... \$365.00  
Smartcom II ..... \$188.00

## Joysticks & Input Pads

### CH Products

Mach II ..... \$67.00  
Mach III ..... \$67.50

### Koala Technologies

Koala Pad W/PC Design ..... \$199.00  
The Speed Key System ..... \$259.95

### Kraft

Kraft Joysticks ..... \$65.00

## Mice

### Microsoft

Microsoft Mouse ..... \$227.50

### Mouse Systems

PC Mouse ..... \$239.20  
PC Mouse/PC Paint ..... \$277.20

## Bill Boards

Compuserves Starter Kit ..... \$59.00

## Toshiba Hard Drives

**MK 53FA, 43.5 Meg** ..... **\$2579**

**MK 54FA, 60.5 Meg** ..... **\$2725**

**MK 56FA, 86.5 Meg** ..... **\$2898**

Controllers available.

## Multiflex Products

### Multiflex Economy Video Display Terminal

Now available from MULTIFLEX is an economy video display terminal. Originally designed as a low cost access unit for our mail-ordering and bulletin board system, this terminal is a semi-intelligent system which is controlled by a Z80A microprocessor and a 6845 CRT controller chip. The keyboard is fully ASCII encoded and the character generator contains the full 128-character set as well as a 128-character alternate set both of which are in the 5x7 dot matrix format. The screen display is 80 characters by 24 lines if the unit is hooked to an external monitor. (Monitor not included). There are 3 software selectable attributes (dim, reverse video, and alternate character set) which can be chosen one at a time for the whole screen. The attribute can then be switched on and off for each individual character. A 2K buffer is provided for normal operation. However when the optional 6K memory upgrade is purchased, 4 screen pages can be loaded from the host machine, edited, locally, and then downloaded back to the host again saving on connect time and phone line bills. Also included are 2 RS232 ports: one for a modem and one so that a printer can be attached to the terminal. The baud rates on these ports are software programmable and can range from 110 to 9600 baud. With all these features, you would expect to pay a lot for this system, but all this is available to you, complete with an attractive case, for an extremely low price.

**A&T board with keyboard (as picture top right) with one RS232 and 2K buffer \$169.00**



**Terminal Complete: Tested and 90 days warranty with 2 RS232 ports, 2K buffer case and power supply (Hydro approved)**

**\$299.00**

**Special Pricing is available when both items on this page are purchased together**



6809 Board

Multiflex Terminal

### U of T 6809 Single Board Computer

The 6809 Single Board Computer, designed at the University of Toronto and distributed exclusively by EXCELETRONIX, is a compact hardware unit which was designed originally as a lab board for teaching students about microprocessor systems. Its many features, however, make it an ideal unit for stand-alone control applications or software development systems as well.

The system is designed around the Motorola MC6809 microprocessor. This is an 8-bit processor with full 16-bit internal architecture, 2 index registers, 2 stack pointers, 2 8-bit or 1 16-bit accumulators, a direct page register and a wide range of addressing modes, including a program-counter-relative mode. This mode allows the user to write completely position independent software, important in systems software development.

There is provision for up to 48K bytes of dynamic RAM on-board. The refreshing of this RAM is controlled by an 8202 Dynamic RAM Controller. This chip allows for completely transparent refreshing of the RAM (ie. no wait states to slow the system down). There is also provision for up to 12K of EPROM using 2532 chips.

There are 4 complete I/O circuits built onto the board. 2 of them are serial (RS232); one is used for a terminal (which is required for use of the board with the supplied monitor software), and the other one is user definable, but it is set up to

communicate with either a modem or a printer. Also on-board are 2 6522 VIA chips. These provide 2 parallel ports per chip along with 2 16-bit timer/counters. One of the parallel ports and one of the timers are used by the monitor software to provide a cassette interface (which operates at 300 baud). The second parallel port on that chip is wired into a connector which is ideal for interfacing a parallel printer or keyboard. The 2nd VIA is not used at all and is completely free for the user. For further expansion of the system, a fully buffered version of the CPU signals (data, address, control lines and a signal indicating whether or not the current address is located on the board) is available at a cable connector.

The software provided with the system is in a 2532 EPROM and allows the user to: test the memory; dump blocks of memory; examine and modify single memory locations; read or write from the cassette port; set and examine breakpoints; single step and/or execute machine language programs and set and examine the processor registers. All this is accomplished through a 9600-baud terminal interface (one of the serial ports). Included is a full screen editor/assembler which allows the user to work in 6809 assembly language rather than machine language. All this makes this board an ideal trainer, control unit or software development unit for just about anyone.

Includes U of T course documentation

**A&T with 48K  
\$299**

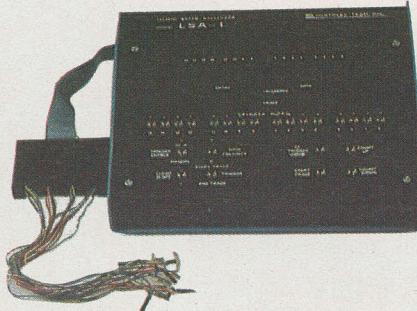
# Multiflex Low-Cost Logic State Analyzer

Ideal for educational institutions and hobbyists.

You've just completed a microprocessor system, and it doesn't work. What next? You can use an oscilloscope to check for clock signals and the like, but if everything appears to be in order you can't go much further without sophisticated equipment. In these situations, professionals turn to their logic state analyzers, each of which cost thousands of dollars. MULTIFLEX has the answer for all those people who don't want to take a mortgage on their house just to get a computer working. The MULTIFLEX Logic State Analyzer has all the essential features of those more expensive units at a fraction of the cost. This is a high-quality piece of test equipment, suitable for industrial or scientific use, but its price is well within the price range of a hobbyist.

Easy to understand and operate, the Logic State Analyzer allows you to monitor 16 points in a digital system (i.e. data and/or address bus, or control lines) which carry continually changing signals. You can select a bit pattern you expect will appear at these points. Once the pattern appears the Analyzer will trigger and record ("freeze") the next 1023 bit patterns so that they can be examined step by step even though data is no longer available in the unit being examined. For software development the Analyzer is invaluable, especially in dedicated systems. If you design a microprocessor system for a specific function, and you have no monitor, assembler or other such software, the best and often only way to debug the system is to use a logic analyzer. It will let you look closely at the data flow as a program is executing, or monitor the address lines to make sure that the instructions are being executed in the proper sequence. The various control lines such as memory read and write, DMA, interrupts, or enable and disable signals can also be examined. You can, of course, monitor any combination of these signals, such as the data bus and half of the address bus, or half of each plus 4 control lines. The combinations are endless.

Complete, assembled  
and tested  
**\$369**



## Note from Industry to Educational Institutions:

At Multiflex we interview many technicians each year, from a variety of Colleges. Only a few applicants know what a Logic State analyzer is and even fewer know how to use one.

Yet in our industry, it is almost as important to know how to operate logic analyzers as it is to use an oscilloscope since the technician will need to use a logic or timing analyzer to trouble-shoot complex equipment.

We have spoken to many other companies and found that they are experiencing the same problems with technicians coming fresh from College. So, we asked educational institutions why they don't teach this aspect of electronic engineering. The teachers are fully aware of the problem but explained that they cannot afford the high cost of logic analyzers; even those institutions which have them can afford only one or two which gives the students little chance to learn them.

Our LSA is a time-proven product which is considerably less expensive than the alternatives.

Here is your chance to prepare technicians for the real world!

## EPROM Emulator

If you are a computer designer who values your time, you can't afford to be without this!

Did you ever write a piece of code, burn it into an EPROM, plugged it in and it didn't work?

Did you then go through the code (using an analyzer or your brain power) and then discover you left out some crucial byte which caused the processor go the point of no return?

If the above holds true, how many EPROMs have you reprogrammed, erased and damaged? More important how many hours have you wasted?

Put an end to all the above problems and save time, money and frustration: Buy an EPROM Emulator.

It allows you to download over RS232 (at 300 to 9600 Baud) a program from your computer into the Emulator's memory (16Kx8) and then simply plug a 24 or 28 Pin header connected via ribbon cable to the Emulator in place of your EPROM and you have successfully emulated an EPROM.

If you need to change your code, simply change it on your computer, download to the Emulator's memory and you are back in business in seconds.

This stand-alone product emulates the following EPROMs: 2716, 2732, 2764 and 27128. Can be used with any computer with an RS232 interface.

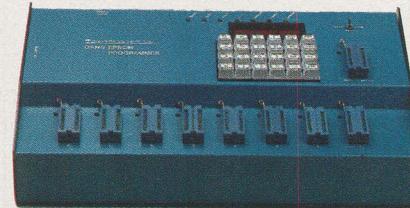
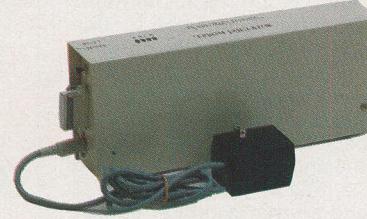
This product is a must for any hardware development since it allows the user to test and modify EPROM data roughly 20 times faster than conventional methods.

The Emulator normally comes attractively packaged and contains its own power supply. However, to make it more affordable for beginners, we have separated the price into several categories:

1. Complete Emulator with 16Kx8 memory, attractively packaged with power supply. Fully assembled and tested with warranty. .... **\$189.00**

2. As above but with 8Kx8 of memory ..... **\$159.00**

3. Emulator with 4K RAM, no housing or power supply (requires +5V at 1.5A Max, +/- 12V at 0.03A. Fully assembled and tested. .... **\$99.00**



# SPECTACULAR GANG EPROM PROGRAMMER AND EMULATOR

Totally self-contained (has its own display, entry keypad and power supply).

Based on the Z-8 microprocessor.

Can program up to 8 EPROMs simultaneously (anywhere from one to 8 EPROMs at the same time with the information in its own memory or or master EPROM).

Each of the 8 EPROM programming sockets is individually buffered and isolated from one another providing protection in situations when there is a bad EPROM among the eight being programmed. Clearly indicates and singles out any defective or marginal EPROMs prior to or after programming.

After programming the unit does a full VERIFY routine of the EPROM (at a Max Vcc of 5.4V and at a Min Vcc of 4.5V) to ensure high reliability of your EPROMs. Very simple to use.

A standard unit contains 8x16K of on-board memory which is sufficient in most cases, but can easily optionally be upgraded to 8x64K of on-board memory.

The Gang Programmer can handle a wide selection of EPROMs: 2716, 2732, 2732A, P2732A, 2532, 2564, 2764, 27128, 27128A and optionally upgradeable to handle 27256, 27512, 2758 and 2724.

Gives you option of entering the data which you want to be programmed on the EPROM through a built-in keypad and display into the EPROM programmer's built-in RAM or by downloading the data to be programmed by

RS232 interface (110 to 9600 Baud). The RS232 is standard — not optional!

Data can be checked or modified, since you can examine any memory location of the programmers built-in RAM, this holds true even after you have down-loaded through the RS232 from your computer; you can check or modify the memory before finally programming it on your EPROMs.

Read Master EPROMs; you can plug in a programmed EPROM, dump it into the programmers RAM, check the contents on display by stepping through the memory and, if you wish, you can alter any location before copying to other EPROMs.

EPROM Programmer can also be (optionally) used as an EPROM emulator, saving hours of frustration, reprogramming and waiting.

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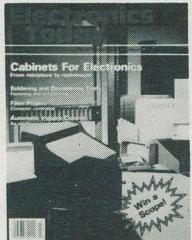
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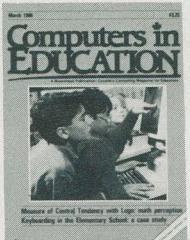
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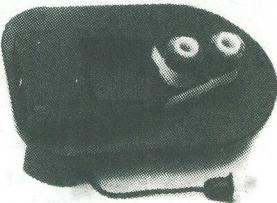
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# Software Now!

## Section

## Tools for Writers

If you write on an IBM PC, you may be dawningly aware that there is life beyond WordStar. In fact, there's a whole teeming swamp of it, all ready to turn your keystrokes into literary platinum.

by Frank Lenk

Different people use their computers for different things. In doing magazine articles, I'm called upon to try out all sorts of weird software, serving applications that often seem to have been culled from schizophrenic nightmares. No matter what peculiar equipment one comes across, the common factor is always the writing up of the experience. Writing is the one thing all articles have in common.

Even if you don't happen to work for a magazine, and your first novel is still languishing in chapter one, you can end up doing a lot of writing... whether doing some kind of office work or just lounging around at home trying to organize your shopping list.

There's an overwhelming supply of software available to ease the strain of getting words on paper. None of this stuff will turn the average third grade dropout into Leo Tolstoy. However, there's more than one package that can supply a Cyrillic character set, so you can feel free to follow in old Leo's slavic footsteps.

The following is a brief connoisseur's guide to what's best in electronic implements for work of wordsmithing.

### Requiem For A Star

Naturally, if you intend to bash out volumes of verbiage, the first thing on your shopping list will be a decent word processing program.

Once they'd forsaken their old manual Remington typewriters, time was when hard nosed writers had only one real choice in word processors, the infamous WordStar from MicroPro. This much maligned program offered a number of unique advantages. Contrary to all popular misinforma-



tion, it was easy to learn... certainly by comparison with other software of similar capabilities. It had pull down menus long before the term became popular. It showed on the screen exactly what it would print out... something that many modern programs have forgotten how to do. It was also small enough to use reasonably well on even a single floppy disk. Lacking copy protection, it could be moved around at the user's convenience.

Unfortunately, MicroPro has declined to upgrade the original, rapidly aging WordStar 3.0. While other companies have gone to great lengths to serve the user base that made MicroPro a success, MicroPro

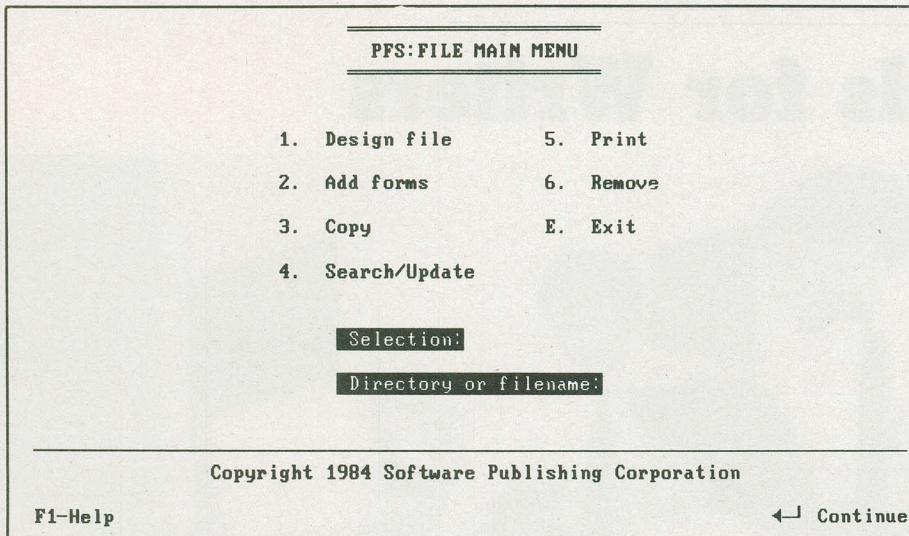
itself has utterly failed to take advantage of its leading position. The unwieldy WordStar 2000, despite its name, owes little to the spirit of the original WordStar. The good news is that a number of excellent new word processors have more than taken up the slack.

One of the best of these newcomers... at the beginner's end of the scale... is the oddly named Executive Writer, from Paperback Software. This system incorporates much of the same wonderful user interface that made WordStar such a pleasure to work with. It also adds plenty of advanced features, such as keyboard macros, online help, importable graphics and more. The program's

## Tools for Writers

main drawback is its copy protection, although this is offset by its low price.

the features a really demanding user might desire.



The real power of Executive Writer only becomes apparent once you sample some of the other applications in the Paperback series. In addition to the Writer itself, you can get the Paperback Speller and the Executive Filer. Both of these integrate nicely with the word processor and turn it into a very high powered personal productivity system. I'll be discussing the other sections of the Executive package a little further on.

For the average working writer with some knowledge of the PC-DOS environment, my personal recommendation is PC-Write, from Quicksoft. This is not the easiest word processor to learn, but it is by far the most flexible. It makes an excellent second word processing system, for someone who's outgrown their entry level software. You might want to see the review of PC-Write in the March 1986 edition of Computing Now!.

Being distributed as shareware, you can get PC-Write for just ten bucks. Even the voluntary registration fee of seventy-five dollars is not much compared to the cost of any comparable package. PC-Write is small... considerably under a hundred kilobytes for the entire system... and blisteringly fast. It is also totally user configurable, making it ideal for the writer who handles numerous different types of tasks. PC-Write is an extremely well behaved program, producing pure ASCII text files and operating perfectly in conjunction with virtually all other PC-DOS programs... including all of the accessories I'll be describing further along.

Bob Wallace, the program's author, continues to make massive improvements to it. The next version of PC-Write is now in beta test stages, and should be publicly available in April. At this present time, however, PC-Write still does lack some of

If you want something that will let you edit huge files, with top notch footnoting, table of contents, indexing, macro programming, and even databasing functions, you can do no better than to consider XyWrite, from XyQuest.

XyWrite is just as configurable as PC-Write. It features enormously powerful keyboard macro capabilities, and is probably the only truly programmable word processor ever built. High level XyWrite functions all work through a command line interface. The benefit is that command words can be strung together in a program file, making repetitive editing or formatting chores a thing of the distant past.

voir, XyWrite will begin spilling text onto your disk.

On the down side, XyWrite is one of the least well behaved of all PC applications. It steals total control over the screen and the keyboard, utterly precluding the use of such utilities as SideKick or ProKey. Furthermore, XyWrite's potent formatting capability is gained at the expense of a "what you see is what you get" display. There's a print preview feature, which helps somewhat but still doesn't show your text exactly as it will appear on the printed page. This is a small price to pay if you are doing massive documents that really need all the fancy footwork that XyWrite can provide.

### Body Copy

A good spell checker can work wonders at cleaning up your copy. It won't help the content, but even rubbish comes across better when it's spelled correctly.

A good solid choice is Webster's New World Spelling Checker, published by Simon & Schuster and designed by Korenthal Associates. Webster's may not be the ultimate in high technology, but it has to be one of the best all round writing tools available. Furthermore, the price is right.

Webster's works with most of the slightly demented text file formats used by common word processing programs. There's no copy protection and the dictionary files can be tucked away in a subdirectory on your hard drive. All the Webster's files can reside comfortably on a single floppy disk.

Running a spelling check takes a few minutes. You get a chance to preview all the unknown words, most of which will usually turn out to be things like proper names or abbreviations that you'll want to neglect

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The entire XyWrite system resides on a single floppy disk, while packing easily as much power as five disk monstrosities such as Multimate or WordStar 2000. There is no copy protection, amazingly enough. XyWrite uses the PC's entire memory space, allowing you to manage half megabyte files right in RAM. Should you somehow succeed in filling this vast reser-

from further processing. You may want to add some to the auxiliary dictionary. The rest will be shown in context, highlighted, and with a selection of alternatives. Webster's really shines in its ability to suggest correct spellings. You can insert a suggested correction directly from a list of possibilities.

There are other good choices besides

## Tools for Writers

Webster's. Even if you opt out of the executive system, the Paperback Speller may still be of interest. It will work equally well with files generated by Executive Writer, WordStar, NewWord, Volkswriter and PC-Write... or with pure ASCII text files of any other origin.

Like Webster's, the Paperback Speller displays highlighted misspellings in context and provides a list of guesses as to the correct spellings. You can select from the list, or correct the word manually... or choose to retain the original spelling. Naturally you can add words to your vocabulary, either for the single session or permanently on disk.

Your previous operation is always shown on screen, and you are free to back up and change your mind about it. Also, you can call up a vocabulary display, which will show a range of dictionary words, selected according to standard DOS question mark and asterisk wildcard conventions. Paperback Speller also includes some nice library management utilities that let you edit your dictionary files.

Paperback Speller keeps its dictionary files in memory during operation. Provided you have enough RAM, this is an advantage. You can check multiple files very quickly during a single session, loading dictionaries from the disk only once. If not for the program's copy protection and its limited handling of disk directories, I'd rate it at least as good as Webster's. As it is, you might want to check out both before making a final decision.

yet to be. It is strange how little effort software publishers have put into providing filing options for writers.

The average database is fine for storing discrete pieces of information... names, addresses, accounts... anything that can be parcelled out in fixed length fields and records. Unfortunately, writers deal with this sort of information only occasionally. Most of the time what's needed is more like the old index card file... free form storage for random blocks of text. This could be story leads, recipes or half finished letters to Mom. Typically you have a rough idea of the form but don't want to be held down to a rigid size and shape.

The only free form database I've seen for a reasonable price is PFS:File, from Software Publishing. PFS:File is a wonderful piece of software. Unfortunately, the free form text structure seems to have come to the creators of PFS purely as a side effect, simply the most logical way to construct a user friendly filing program. On its own terms PFS succeeds.

The principle of PFS:File is beautifully instinctive. You are shown a blank screen, on which you can freely paint field labels. When you start entering data you are presented with your completed screen, the labels now highlighted and protected from accidental overtyping. Using the tab key you can flit from one label to the next, entering as little or as much text as you like. Text can go anywhere on the screen, and if you run out of space PFS will create new, blank attachment pages.

"NAME:" would search for all records having a NAME entry starting with B. The two dots act as a wildcard.

It's that simple. Any fool can grasp it in minutes, and yet it provides all the functions of more massive database software.

The more demanding user, however, will find much to quarrel with. First of all, PFS has no provision whatever for indexing or the creation of key fields. Therefore searches always proceed at much the same speed, tediously slow.

Second, PFS:File provides none of the screen formatting that would make free form text entry really powerful and pleasant to use. Text just splats down where you put it. You get word wrapping but no margin control and no paragraph formatting. You can export data in text file form, but there is no provision for importing text to a card file.

Finally, the PFS:File program is large and ungainly, considering what it provides. The basic EXE file is almost seventy kilobytes long, yet it doesn't even include rudimentary reporting functions... which must be purchased separately, under the heading of PFS:Report. Both File and Report are thoroughly copy protected.

The original Apple version of PFS:File... like the early CP/M WordStar... was a breakthrough in sophistication. The newest PC version of PFS:File... like the latest WordStar... has added only minor command refinements, and failed to develop the real potential that was shown at the start. As things stand, I still find PFS:File the best way by far of keeping card file type information... but only because there's nothing else like it. The huge, expensive database systems like dBASE III are completely incapable of dealing with even a few sentences of formatted text. At least PFS can provide word wrap.

To be sure, there are alternatives. However, of those systems priced within human proportions, the only other practical choice would probably be Executive Filer.

Executive Filer is an admirable piece of software. It has many of the characteristics that make PFS:File so enticing, and adds to them an excellent integration with Executive Writer. While working in the latter program you can instantly pop out to Executive Filer, retrieve a card, and import it directly into your text. This is exactly the sort of thing that the busy writer would like to do several dozen times a day. Unfortunately, unless you do opt to make Executive Writer your primary word processor, you'll be quite unable to take advantage of this sort of transparent operation.

As a stand alone program, Executive Filer manages to do wrong all the things PFS does right... and vice versa. Executive Filer has all the formatting and editing functions that PFS:File should have... in fact, it virtually recreates the screen editing of the Executive Writer. It also has a tree type keyword retrieval structure that makes sear-

### FILE:flange

- (F1) ADD a record
- (F2) MODIFY a record
- (F3) DELETE a record
- (F4) DISPLAY a record
- (F5) FIND a record
- (F6) LIST or clone
- (F7) SORT the index
- (F8) see the record LAYOUT
- (F9) alter a Field NAME
- (F10) END or change database

Your Command: \_\_\_\_\_

PC File opening menu.

### Single File

If you work with words, you'll know that the writing is only half the battle. Much of the writer's life is spent storing and keeping track of what has been written, or what has

To retrieve a record from your file you once more use the blank, labelled screen. This time instead of actual data, you enter search criteria next to the labels. For instance, an entry of "B.." next to a label

ches enjoyably rapid. Yet it leaves out one vital feature, this being fields. There is no way in Executive Filer to lay out a template screen. Every time you write up a card you start from scratch.

The lack of field layout also means that you can never search your file based on the actual text on the cards. You must always search by keywords. If you forget what keyword you've used, your only chance is to list all of them and then try to pick out the ones that identify the card you're looking for.

The upshot is that for the foreseeable future writers will probably continue to deal with napkins with scrawled notes on them, backs of matchbooks, and huge filing cabinets full of... ugh... paper.

If all you want to do is keep track of tabular information, you'll fare rather better. If you've got the bucks, there are plenty of large scale database systems that will fulfill your every whim. There are also some cheaper solutions... one of the best of which is PC-File, from Buttonware.

Like PC-Write, PC-File is distributed on the user supported plan. You can get it for nothing, and you should pay for registration only if you find you're getting value from the program. Chances are you will. Most of us need to keep at least address files, if not more diverse types of reference materials. PC-File will handle these with ease. The main menu lets you do all the things you really need, including creating a file format, adding records, searching for information and even generating very fancy reports. PC-File is fast, compact and not copy protected.

Somewhere midway between the well defined categories of file managers and text processors lies the no man's land of idea processors. The leader in this underpopulated field seems to be ThinkTank, from Living Videotext. Despite a few limitations, ThinkTank makes a worthy addition to the wordsmith's arsenal.

Almost any task above a certain size can benefit from a little preplanning. If you plan in diagrammatic form you end up with something like a flow chart. If you prefer to use text, you'll end up with a series of point form notes, essentially an outline. ThinkTank is an outline processing device. It lets you swiftly jot down headings and subheadings, and flip between compressed or expanded views of the structure as it grows. ThinkTank can be thought of as a highly peculiar sort of database, but it really looks more like a word processor with very powerful table of contents operations.

Unless you work primarily with very cut and dried types of writing tasks, you'll probably only drag ThinkTank out occasionally. When you do, though, it will probably be to solve a problem that might have taken hours more to work out in any other way. ThinkTank has some text editing operations built into it, so you can build up something closely resembling a complete document

## Tools for Writers

Name: Hungadunga, Harold H.

Phone: 201-555-2314

Address: 39 Flangetree Lane

City: Albuquerque

State: NM

Code: 43219

Comments: Did not send me a Xmas card last year, but has lots of dough and cannot possibly last much longer. Keep buttered up.

FOOBAR

Form 1

Page 1

F1-Help

Esc-Main Menu

F10-Continue

### PFS: File record screen.

before outputting either to your printer or to a text file.

The greatest shortcoming of ThinkTank is that it is not a complete word processor. To get around this, Living Videotext has released a new co-resident version, called Ready!. Unfortunately, although this was a logical move in theory, considerable compromises were required. Ready! has no text editing capabilities at all. Instead, you are expected to paste outlines directly into your word processor. The problem with this approach is that it only works one way. Once the outline is pasted in, you lose all of the neat idea processing functions. For this reason I still prefer the fuller functionality of the original ThinkTank. The final choice may be a matter of personal taste, but I'd hate to face life without either one system or the other.

### Putting Out

There's no use processing all those words if you can't get them out onto paper. In the past a good letter quality printout was possible only with the aid of a daisy wheel type printer. This meant that you had to abandon desirable dot matrix capabilities such as high speeds or graphics.

Now it's possible to have your cake and eat it too. There are several excellent pieces of software that will permit you to create letter quality output... in a variety of type styles... on your dot matrix printer. The two major choices seem to be Lettrix, from Hammerlab, and Fancy Font, from SoftCraft. You might want both.

For day to day use, I've found Lettrix to be an indispensable companion. Co-resident with your word processor, Lettrix intercepts the printer port data stream, interprets it, and replaces it. You merely print as usual. Lettrix takes a line of output, reads the ASCII characters, adds special printer

effects as you've specified them, and then translates the whole thing into high resolution graphics codes. The result is that the print head does two passes with a fractional line feed between them, creating lovely letter perfect print. Lettrix does all the necessary calculations to do effects like emphasis, underlining and italics. It will do double width and even double height characters.

Lettrix comes complete with a great selection of font files. You can load up to seven at a time, and then select them by number. You can also create your own fonts, using a handy editing utility.

Controlling Lettrix is a snap. Most of the parameters can be set up manually from a pop up menu. Standard escape codes are picked up during printing, or you can use the special Lettrix backslash sequences instead. The only problem I've ever found in Lettrix is that a long series of escape commands will seemingly overflow an internal buffer of some sort and produce nonsense at your printer. If this happens, going over to backslash commands will help remedy the situation. Of course, a large number of backslash codes can strain the right justification capabilities of the system... but then font changes should always be used with restraint.

Fancy Font is the powerhouse of letter quality utilities. However, it is more demanding of the user. You have to format your file using Fancy Font codes exclusively, then print it using the Fancy Font program. The basic printing technique is the same as with Lettrix, but Fancy Font uses over a dozen passes of the print head to create incredibly crisp typeset quality characters. This process is slow, and quite a beating for your printer ribbon. This makes Fancy Font more suitable for the occasional engraved invitation rather than for day to day printing.

## Tools for Writers

Guesses:  
1-hands  
2-hinds  
3-hods  
4-ends  
5-hand

File: SHERLOCK.TXT

Current Suspect: [Line:10] HNDS  
Previous Action: Changed [Line:3] ADN to: and

'Having found nothing, they tried to divert suspicion by making it appear to be an ordinary burglary, to which end they carried off whatever they could lay their hands upon. That is all clear enough, but there was much more that was still obscure. What I wanted above all was the missing part of that note.'

[Line:10] HNDS

Accept Insert 1st 2nd 3rd 4th 5th Replace Erase Undo Look-up Mark Vocab Quit

Paperback Speller main screen.

| Webster's New World Spelling Checker   | c:tools  | Automatic scan  |
|--|--|---|
| turn the average Grade Three dropout into Leo Tolstoy. However, there's more than one product that can supply a 'cyrillic' Russian character set, so you can feel free to follow in Leo's footsteps. |  |   |
| The following is a brief <b>connaisseur's</b> guide to what's best in electronic implements for work of word-smithing.   |  |   |
| <b>Requiem for a star</b><br>Naturally, if you intend to bash out volumes of verbiage, the   |  |   |
| Word in question: connaisseur  | Possible spellings:  |   |
| Replacing & Editing<br><↑>/<↓> Select<br><Enter> Replace<br><F1> Replace to end<br><Esc> No replacement<br><←>/<→> Edit word<br><Ins>/<Del> Insert/Delete<br><F2> Erase word                         | Dictionary Reference<br><F5> Set scan level<br><F6> Suggest spelling<br><F7> Look up word<br>(PgUp to A, PgDn to Z)<br><F8> Add the word<br><F9> Whoops!<br><F10> Quit spell check | connoisseur<br>cannier<br>connie<br>conniver<br>conniseurs<br>concise<br>sonnies<br>cannabis<br>cannabises<br>canna |

Webster's New World Spelling Checker.

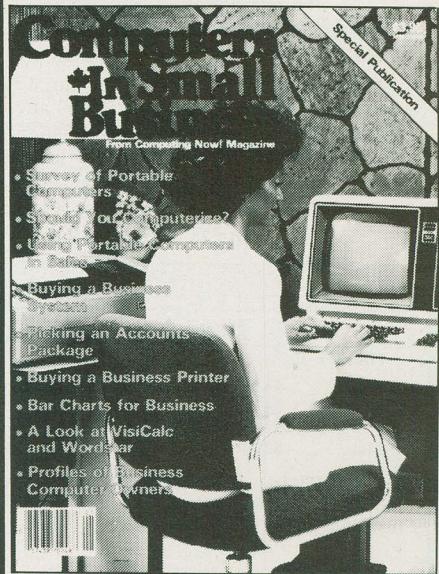
There are now special versions of Fancy Font that will correctly interpret the printer codes used by popular word processing software. For instance, Fancy Word will work with Microsoft Word files. The system will also support the better known

laser printers such as the Hewlett-Packard LaserJet or Canon Laser.

Like Lettrix, Fancy Font also includes font creation and editing utilities. These are not exactly trivial to master, but well worth the trouble for a heavy user.

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|                                     | *etc *etc *etc              |                                 |

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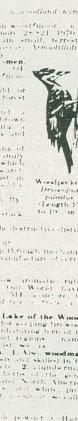
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# **Memry Rezident Spelink Chekurs**

Not beink abel to spel duzn't make yu illiterat. It mite make yu want tu  
bi sum softwair, tho.

bi Don Roy

**S**omehow, it all returns to haunt us when we look back at the low marks achieved in English class. The importance of being able to correctly spell abominations like *altruistic*, *remuneration* and *homologue* seemed to rank on the same level as advance planning for root canal work. For many, it still does today.

Perceptions are wonderful things. Even the most masterful presentation, report or letter can easily be marred by just a few spelling errors. The consequences of such a disaster can seldom be either measured or attributed easily to something as trivial as a

couple of typos. For those not willing to take the risk, the recently emerged generation of memory resident spelling checkers may be a worthwhile investment... if only for some increased peace of mind.

In this article, we'll have a look at several packages having this type of ability. While some are novel variations on an old theme, others promise significance beyond what their five inch square envelopes hold today.

## Spelling Hornets

The spectrum of software we'll look at here

shows a broad range of direct and add on capability. In common, they are able to verify the spelling of words that are sent from a keyboard, ultimately for other, more conventional forms of processing. All are partially or entirely memory resident... allowing them to work on your input in real time.

When the first generation of spelling checker programs emerged from the seas, they were only usable in a *batch* fashion. A document would have to be created first, with the checker called as an afterthought. Invoking a separate utility, or sub program

## Memory Resident Spelling Checkers

to do this did not always lead to the most convenient arrangement. In business use, many documents can contain up to three bags full of company or industry specific terms that will never be found in a dictionary.

Putting the whole affair into an active state in memory allows for immediate feedback. Often, errors are simply typographical, and easy to blame on someone else... if you get the opportunity. A common form of this shows as transposed letters in a common word, which everyone would know how to spell. Somewhere, a minor short circuit along the path from cranial lobes to finger muscles often results in the common word, *hte*, showing up in my drafts of reviews or articles. All of the packages to be looked at can warn one of such indiscretions as soon as they happen. However, some provide additional aids to the writing process that make them handier to use... if the particular abilities are ones you need.

*The Resident Speller*, from S&K Technology should be considered a spelling utility program. Offering both resident and stand alone modes of operation, this program lacks the ability to suggest alternate spellings while it's in use. It keeps a main dictionary, composed of a bit under fifty thousand words, in memory, so that disk accesses are not required. The approach is useful for those not having a hard disk or lacking bountiful memory chips.

*The Resident Speller* ties up ninety kilobytes of memory for its own use in resident mode. Additional address locations for DOS, application programs and working files will increase the memory needed for successful application. Stand alone operation, which will filter ASCII files for objectionable words, will run quite well with just under two hundred kilobytes of RAM, regardless of the size of file being checked.

A somewhat more flexible package is to be found in *Whoops!*, produced by Corncopia Software. Offering the same kind of "as you type" verification found in the previous package, one can also disable this in favour of a "screen proofing" style of spell check. Both packages, when hanging on your every keystroke, will signal potential errors by beeping the PC's speaker. The screen proofing operation of *Whoops!* puts your word processor on hold while it looks at everything in the display memory. Errors are highlighted for one's inspection.

This method, however, is not quite foolproof. Screen proofing with WordStar will usually produce a misspelled word shown as "L---" being the first five characters of the word processor's ruler line.

Once an error is detected, there are a few options to handle it. One key sequence will allow dictionary access, a file also of fifty thousand words for the investigation of misspelled words. In the screen proofing

juiced  
juicer  
juicers  
juicier  
juicily  
juiciness  
juicing  
juicy  
july  
jubilant  
jubilation  
jubilee  
jubilees  
judicial  
judicious  
judaism  
judge

===== > "judgement" was not found.

Use arrows to scroll. Hit <RETURN> to return.

judges  
judged  
judger  
judgers  
judging

The peril of alphabetic search: (1) The correct spelling is just one line below what is displayed.

juicier  
juicily  
juiciness  
juicing  
juicy  
july  
jubilant  
jubilation  
jubilee  
jubilees  
judicial  
judicious  
judaism  
judge

===== > "judgement" was not found.

Use arrows to scroll. Hit <RETURN> to return.

judges  
judged  
judger  
judgers  
judging  
judgment  
judgments  
judiciary

Alphabetic search: (2) You have to search for possible alternatives by scrolling through the dictionary.

mode, the same combination will restart the highlighting of errors.

It is, however, up to you to access the dictionary and fix an incorrect spelling with your editor. Since *Whoops!* runs entirely in the background, it has no interface to the word processor... and thereby, no ability to affect what is being displayed.

Now, take a moderately capable word processing program and tie in a routine with this type of checking ability and what you have is something like *AI:Typist*, as sold by Airus. The package is promoted as using artificial intelligence to assist the detection of errors in text. There may be something to this, since the control routines are able to signal a possible error before the word is completed. The previous two products will not jump off the fence until a space or other word delimiting character has been typed.

The heart of this ability is a module, incorporated into the word processor, that allows dictionary searching to progress between typing keystrokes.

The included dictionary file is small in comparison to other programs and, at times, results in fairly common words being incorrectly accused. A surprising example is the word "entry", which was flagged as wrong. With only about twenty-five thousand words on file, *AI:Typist* also seems to have some difficulty with the plural versions of words. Happily, the process of adding words to the dictionary is simple and fast.

The word processing part of the program, as I mentioned, is moderately capable in terms of common features. If you don't need the powerhouse abilities of WordStar or Word Perfect, then it will suit you well. Things like block manipulations, search and replace, cut and paste, page formatting and print enhancements are available. Making extensive use of eight function keys, *AI:Typist* is decidedly flavoured along the lines of *MemoMaker*, a similar level package from Hewlett-Packard. The latter, of course, does not have the on line spell checking ability.

When errors are detected, the Airus package will both sound an alarm and highlight the beginning of the offending sequence, *within* the word. This is a most helpful approach, compared to those that simply beep their protestations at you.

### **Lightning Strikes**

As a favoured source of innovative software, Borland International has released *Turbo Lightning*. If you could make a wish list for resident spelling check programs, you would find most items included in this package. *Lightning* is endowed with not only a complete copy of the Random House concise dictionary, but with the facility to suggest the correct version of the word you want... and, should you desire, it will insert the correction into your word processing

document. Similar capabilities are available, if you find yourself using the same words too often, to access the standard Random House thesaurus.

While smaller versions of both the dictionary and the thesaurus must be used on systems not having a hard disk, on line help is available and the amount of memory that is consumed is selectable, within limits, during the installation routine. To use *Lightning* you must have about an eighth of a megabyte of installed memory, two disk drives... one of which can be a hard drive... DOS 2 and, of course, an IBM PC or truly compatible machine. The "truly compatible" business appears to be serious in this case. While the package loaded and ran very nicely on both a PC and an AT, it would well and truly send my "compatible" clone into a state of eternal navel gazing.

The dictionary contents exceed eighty thousand words, making it, by a factor of sixty percent, the largest of the group. However, without a significant amount of data compression and efficient retrieval techniques, this amount of information would be more of a hindrance than a help. To accomplish this, Borland has subjected the dictionary to character frequency and pattern recognition algorithms that allow the most frequently occurring letters in the alphabet to be assigned codes. Words are stored in a manner that logs only the letters that have changed from the previous entry, instead of having to hold onto the entire word.

Using this representation, locating entries with a two level tree indexing system results in very rapid searches for the needed point in the file. While alphabetic checking of misspelled entries is helpful, *Turbo Lightning* also has the ability to invoke a sound alike algorithm that will attempt to present what you meant to type. This commences with a check of commonly transposed words, followed by a comparison with dictionary entries that begin with the same letter as the errant one and are also of similar length. The most promising replacements are held for presentation, but lacking enough candidates, a phonetic check will also be made. When the final list is presented for inspection, the words are arranged in order of the most likely possibilities.

All of this happens with relative rapidity. The internals of *Lightning* promise much more efficient and, therefore usable, text based reference software. While organizing a dictionary for speedy retrieval can be a fairly easy task given the right development tools, achieving the same kind of result with a thesaurus is a somewhat more difficult task. Despite this, the package does a highly commendable job in finding similar words to the one selected. Borland International will be releasing a set of tools for software developers wanting to apply *Lightning's*

principles to their own works and has already shown some of the needed principles in the *Turbo Editor Toolbox*.

### **Off To Work**

Using *The Resident Speller* requires three commands from the DOS prompt. The first loads the operating parts, the second installs the dictionary file and the last jump starts the resident operation mode. Actual spell checking is activated with control shift five that is also a toggle to turn the program on and off. Once loaded, the memory space occupied is unavailable to other programs until your machine is rebooted.

Provision is made to have an alternate dictionary loaded with the main one, primarily for those terms you may use that are not found in a common dictionary. From within another program, words that are unjustly accused can be added to the alternate list with alternate shift five, though to permanently save the additions a separate operation is required after quitting the application. Since *The Resident Speller* does not affect the active program, it can be equally applied to word processors, spreadsheets, language editors and databases. Several alternate dictionaries can be established, but switching among them must be done at the DOS level.

To use *The Resident Speller* in a stand alone mode, the file being checked must be available in ASCII format. Putting this version of the program into operation results in a menu display that allows files to be checked, verification of words typed from the keyboard, changing of alternate dictionaries and general dictionary maintenance. Files can be processed in either a batch or interactive manner. The latter form will present suspect words for judgment, allowing several methods of disposition. This interactive operation does allow for the presentation of similar words from the dictionary files and replacement of the errant ones from suggestions. Words may also be added to an "ignore" list if they don't belong in the current alternate dictionary being used.

Due to the methods used by the wide variety of available word processors, some incompatibilities do exist. Those processing their own keyboard interrupts, such as XYwrite and the Leading Edge Word Processor, are totally incompatible with this software. Any which add blocks of control information at the beginning or end of files, such as MultiMate, Word and pfs:Write, can co-exist in *resident* mode but not for stand alone processing. As well, any that are incapable of writing ASCII files will fall in the same category.

Overall, this is a barely acceptable program, since it lacks many important features in its "as you type" checking operation. If *The Resident Speller* were the only program available, it would be a reasonable package

## Memory Resident Spelling Checkers

with its hundred dollar selling price. However, there is a lot of better software available.

One which is slightly higher on the scale is *Whoops!*, if for no other reason than its having a selling price half that of the previous package. This program runs on PCs and compatibles, including the Tandy 1000 and 1200. Some less than compatible machines may require a special version, which is available from the manufacturer. One would be wise to avail one's self of this option if one is not running the genuine thing. On more than one occasion, the program sent my clone into the Twilight Zone, along with anything entered since the last file save. No such misbehaviour was noted during use on a real PC.

*Whoops!* will get along with most popular word processing programs, though Microsoft Word is again singled out for total incompatibility. MultiMate and MultiMate Advantage require additional memory. Also shown as compatible are Lotus 1-2-3 and most other spreadsheets, as well as SideKick and Superkey... if the background programs are loaded after *Whoops!*.

If more than a quarter of a megabyte of memory is available, all the needed files will be loaded into memory for use. Machines with less than this require that the three dic-

tionary files, totalling a hundred and twenty-eight K of space, be installed on the word processing program disk. With this arrangement, the memory overhead is under fifty kilobytes, but it is likely that most non-essential files on your program disk will have to be removed.

Notices of spelling errors are sent out by a "beep" on the speaker after entering the space that ends the word. Two options are available when this happens. If the mistake is obvious, it can be corrected immediately or investigated by placing the cursor within the word and hitting a alternate right shift. This will display the contents of the dictionary file, with a pointer showing where the word in question should have been. Surrounding entries are also shown and others can be scrolled to with the arrow keys on the number pad. It is up to you to make the spelling correction in your document. If the word is one you want added to the dictionary, a menu of options is available from within the document by pressing alternate left shift.

If you choose not to correct the word when the signal sounds, you can go on and later use the screen proofing method to locate potential errors. The option menu provides a toggle between real time and screen proof modes. Settling for the latter

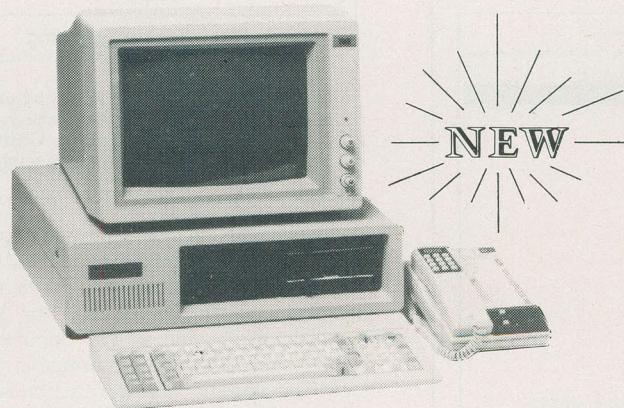
also avoids any problem with fast typists. To do a screen proof, the alternate right shift sequence is again used, causing errors to be displayed with highlighted characters.

The documentation accompanying the program is slim, but adequate. I'm not sure whether the pages were checked with their own speller, but the word "curser" was found on page six, in the context of cursor movement instructions. It is also interesting to note that the word "cornucopia" does not exist in the dictionary files, even though this is the manufacturer's name.

The third entry in this latest software category is *AI:Typist*, which deserves some recognition as being the only package which recognized its master's name... in this case, Airus. Providing some departure from the previous two, this package can highlight errors on the screen in reverse video. The audible signal can be turned off to the undying gratitude, I'm sure, of the poorer spellers among us. The spelling check function is not separable from the word processor, thus it is not an add-on product for other programs.

As already mentioned, *AI:Typist* is able to detect the formation of a misspelling before it is complete, which is unique among the packages herein. It will not, however, offer any opinions about just what

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TEST Page 1 Line 9 Col 34 Insert Horiz

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|          |                   |
|----------|-------------------|
| ^Blocks  | ^Tabs and margins |
| ^Cursor  | ^Locate text      |
| ^Options | ^Next locate      |

^G means hold down Ctrl

|| 1 2 3 4

Borland International's new Turbo Lightning has a dictionary of 83,000 words and the complete Standard Thesaurus, providing very fast access to key guides in English literacy. The package keeps up to three RAM based dictionaries available, allowing the user to control the memory overhead required. Recommended minimum memory is 128K, although more certainly will be found advantageous. While both the thesaurus and dictionary are extensive, it is required to either have a hard disk or to keep one floppy drive available, to use the complete versions of both.

**floppy**  
 Sound alike words =  
 A: flopped  
 B: flopping  
 C: floppier  
 D: floppies  
 E: flossy  
 F: folksy  
 G: Add word to auxiliary dictionary PgUp or PgDn for more words ↓

**Turbo Lighting:** Even if the spelling of a word is correct, a list of sound-alikes from the dictionary can be requested.

TEST Page 1 Line 2 Col 38 Insert Horiz

EDITING MENU

|          |                   |
|----------|-------------------|
| ^Blocks  | ^Tabs and margins |
| ^Cursor  | ^Locate text      |
| ^Options | ^Next locate      |

^G means hold down Ctrl

|| 1 2 3 4

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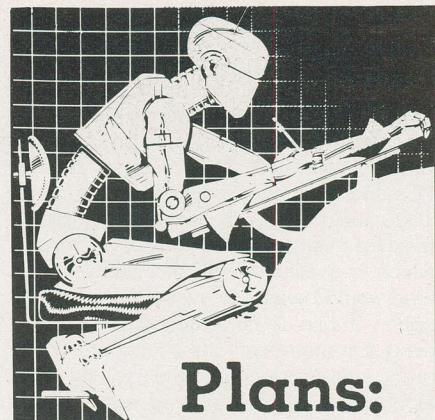
Print enhancements  
 complete  
 Synonyms  
 - Adjective -  
 A: whole  
 B: entire  
 C: full  
 D: intact  
 E: one  
 F: developed  
 G: fulfilled  
 H: finished  
 I: ended  
 J: concluded  
 K: consummated  
 L: done  
 M: perfect  
 - Verb -  
 N: finish  
 PgUp or PgDn for more words ↓

**The Turbo Lightning thesaurus displays synonyms for the word "complete".**

you should have typed instead. Words are readily added to the dictionary and can also be deleted, if you find that it is accepting words incorrectly. An example, since all of these come from the United States, would be the conflict with our British way of spelling words like "flavour", instead of "flavor".

The ability of *AI:Typist* to identify incorrect words before they are fully formed on the screen comes from proprietary technology, which the company is prepared

to license to other software developers. The process centres about a multi-tasking ability to search the dictionary, even while keystrokes are being entered. This routine, called *Airus-A*, resides in less than a half kilobyte of memory and is the focal point of the artificial intelligence references in the package. Even given the current confusion about just what artificial intelligence really is, it is pretty tough to accept concurrent processing as being AI.



## Plans:

|               |   |
|---------------|---|
| Software:     | The Resident Speller  |
| System:       | IBM PC or compatible  |
| Manufacturer: | S&K Technology, Inc., 4610 Spotted Oak Woods, San Antonio, Texas 78249 (512) 492-3384           |
| Price:        | \$99.00   |
| Software:     | Whoops! spelling checker  |
| System:       | IBM PC and compatible   |
| Manufacturer: | Cornucopia Software, Inc., P.O. Box 6111, Albany, California 94706 (415) 528-7000               |
| Price:        | \$49.95   |
| Software:     | AI:Typist word processor  |
| System:       | IBM PC or compatible  |
| Manufacturer: | Airus, 11830 S.W. Kerr Parkway, Lake Oswego, Oregon 97034 (503) 246-1105                        |
| Price:        | \$99.95   |
| Software:     | Turbo Lightning   |
| System:       | IBM PC or true compatible   |
| Manufacturer: | Borland International, 4585 Scotts Valley Drive, Scotts Valley, California 95066 (408) 438-8400 |
| Price:        | \$99.95   |

Marketing hype aside, if you happen to be one of the thirty-three people left with a PC and no word processor to run on it, then this one is worth considering. For general correspondence and shorter documents, it should work out to be a reasonable writing tool. The spelling check is a bonus, considering the asking price, but don't look for the really tricky things that five hundred dollar packages do. The company readily admits that *AI:Typist* was debuted more as a demonstration program for the *Airus-A* concept than as a serious attempt to take the wordsmithing market by storm.

Having the opportunity to spend time on the three packages already discussed makes the appreciation of *Turbo Lightning* even easier. This newest product from Borland International has it all. If you make an error, you still get beeped at, but hitting a shifted function key eight will bring a one line selection menu onto the screen. From here, you can choose to alter the "environment"... what *Lightning* knows about the

## Memory Resident Spelling Checkers

editor you're using... or enter the dictionary or thesaurus, as well as do a full screen check for errors, play with the set up parameters, or meddle with things like the "hot key" sequences that call various functions.

Most operational modes can be accessed directly through alternate key combinations, avoiding the menu, if you prefer. On line checking can be disabled in favour of the screen check method. A good number of current word processing packages are supported, which is important, since *Lightning* can take alternate spellings and place them into your document with seldom more than a keystroke from start to finish.

While the dictionary contents are best described as ponderous, an auxiliary work can be used as well. Allowing room for about three hundred words to be added, this only occupies another two kilobytes of memory. Several of these can be built, but only one can be used at a time. Switching between auxiliaries can be accomplished while *Lightning* is active, which is helpful when using it, say, with both a word processor and a programming language. These small references can be built separately, with an editor, or built over time from the

"add to dictionary" option, shown when a word list is displayed. The main dictionary file cannot be edited.

The operation of the thesaurus is so similar that about the only difference of note is that the replacement word list is normally quite a bit longer. Pressing *Pg Up* and *Pg Dn* will present additional choices. If the word in your document is not to be found, *Lightning* will ask if you want to check close words. These are found through the "sound alike" search routine, which looks in the dictionary file. If you were to select a sound alike, replace it in the text and access the thesaurus again, the synonyms will most often be entirely different from those seen before.

In replacing words from the selection lists, the program is case sensitive, in that if you had started a sentence with the word of interest, the replacement word would also have the first letter capitalized. Similarly, if the word were all capitals or lower case, the replacement would reflect this state.

The program documentation is presented in typical Borland fashion... a paperback book that is well written, profusely illustrated and highlighted by examples. *Lightning*, as is the case for all of the

packages examined here, is not copy protected. A particular protocol is required when using this software with other memory resident packages... be they of Borland heritage or not. Of course, all other non-Borland stuff needs to be activated first. Then, if you are using it, SuperKey should follow. Finally, *Lightning* can join the queue and then the venerable SideKick, if you have it.

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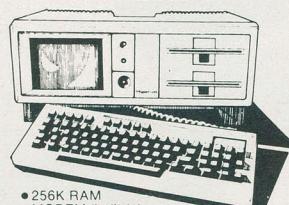
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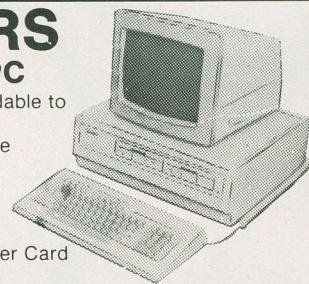
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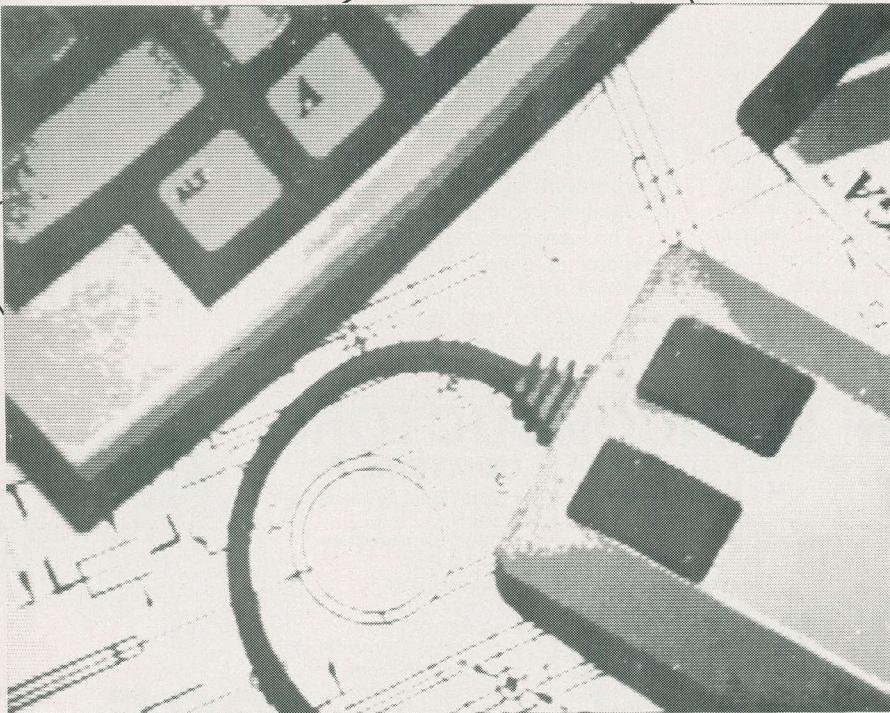
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# Amiga at C



The awesome seething power of the Commodore Amiga just begs for some programming toys. The toys, however, beg for some documentation. In this feature we'll check out the Lattice C compiler for the Amiga, the unsurpassably best programming tools in creation, and some books from Addison-Wesley that'll tell you how to drive 'em.

**by S.R. Ferrybridge**

The more user friendly computers get, the weirder their internal bits seem to want to become. The IBM PC... a pretty good example of a "user nasty" system... comes with a straight forward box of code to drive it. The Apple Macintosh, by comparison, is a first rate cow to program under. The Commodore Amiga makes the Mac look easy... so much so that the Lattice

C compiler we're going to check out here gives one the option of having the Amiga behave like a Mac, if having it behave like an Amiga is too overwhelming.

In a real sense, the Lattice C package that we'll be looking at here as an Amiga programming tool is moderately useless as it comes. As is the case with virtually all serious program development systems, the

Lattice package offers one pretty good documentation to run the compiler... but almost nothing about how to run the Amiga from inside a program. The other half of the party is three volume set of books by Addison-Wesley, to wit, the Amiga ROM Kernel manual, The Amiga Hardware manual and the Amiga Intuition guide. These are expensive little beasts, to be sure,

## Amiga at C

but far from being merely helpful, they're essential for anyone who imagines writing anything other than trivial code for the system.

### Walking The Plank

The three books are of varying usefulness, depending upon what you actually plan to write for the system. However, they're all more or less interrelated, and no one volume can stand entirely on its own.

The most primitive level of the Amiga's operating system is its ROM kernel. In fact, the kernel manual covers routines which live in ROM, in the protected KickStart memory slab... a sort of a ROM, but not really... and, finally, code which is inhaled from the disk as it's needed.

The kernel manual is the thickest of the three, and possibly the most technically involved book most programmers will ever come across. I have no idea how many pages it encompasses... my copy, a preliminary version which could actually get thicker by the time it goes to press for the last time... was almost two and a quarter inches thick. It's actually pretty lucid for what it is, but it's a slow read through the sheer volume of information it contains.

In the same way that Amiga programs aren't really linear lists of instructions, as is the classic structure of a program, the kernel manual isn't designed to be read from the beginning to the end. Like the programs one will... eventually... write based on its information, the book itself is event driven. Its organization is such that it's very easy to plunge into the middle of it to find a bit of detail one wants clarified. Starting at the first page and working through it will leave you hopelessly perplexed.

If you are new to C and writing complex programs, getting into the kernel manual will be a long and painful grind. It's not kind in the least.

One of the things which most programmers who eventually make sense of the Amiga will appreciate about these books is that they're littered with example programs written in C. This is as opposed to the Mac's books, which are all done in... ugh... Pascal. This will not bode well if you're a Pascal programmer, I know...

The kernel... and, as such, the kernel manual... contains most of the interesting basic stuff that the Amiga can get into. This includes the system's graphics, including sprites and animation, task handling, text, disk access, sound, the keyboard, the mouse, the system IO, the built in math functions and so on. I'm not even going to begin to get into exactly what goes on in the chapters devoted to these subjects... they're the size of small books all by themselves.

One of the pitfalls of extensive computer programming is that it allows the muscles to atrophy, what with sitting in front of a terminal for hours on end exercising

only your finger tips. This book will change all that for you. Just spend about half an hour a day lifting it.

### Other Tomes

By comparison to the kernel book, the other two volumes in the set are mere leaflets, being about three quarters of an inch thick each. The skinnier of the two is the Amiga hardware manual. I can still remember when the hardware was the most complicated part.

The hardware manual is actually slightly misnamed... it doesn't only detail the Amiga at the hardware level, that is, encompassing nothing but pages of bus timing charts and keyboard scanning tables. There is enough of this to keep the boys with the soldering irons happy for a month, to be sure. However, it will also prove useful to programmers as it gets into some of the really low level software interfaces to the Amiga, that is, how to make the graphics graph and the sound system bleep without going through the operating system. This is a very powerful bit of information, as it allows one to write very tricky code when one wants to.

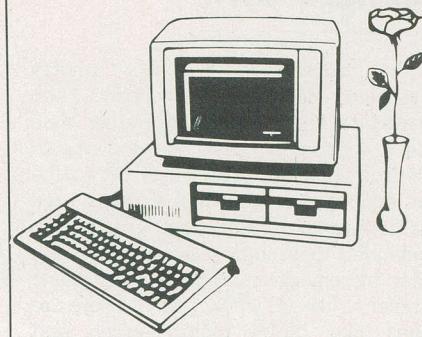
This stuff, even more so than the kernel manual, isn't for the faint of heart, as it assumes a certain understanding of the workings of the chips that make the Amiga go.

The third book in the trilogy, the Intuition manual, will be the most useful of the three for most potential Amiga programmers. It provides painless system calls to handle the things that make up the Amiga's environment, including windows, screens, gadgets, requesters, bit maps and so on. Once again, the book is littered with examples in C, and there's a whole section just oozing with C functions which make the Amiga dance. Unlike the other two books, this one's relatively easy to get into, and one can understand the basis of what's going on in the Intuition package in a couple of hours.

### Climbing The Lattice

By comparison to the Amiga books, Lattice's C compiler package is almost weightless. In fact, I got quite a tottering stack of Lattice software for the Amiga all in one batch. We're going to look at three applications in particular here, these being the Lattice screen editor, the C compiler itself and something called Lattice MacLibrary.

Conceptually, the process of compiling a C program on the Amiga largely presupposes the existence of some vehicle for creating the code to begin with. One takes this sort of thing for granted on other systems, wherein one can just boot up WordStar. In this case, though, the Amiga doesn't have a real host of text editors available for it at the moment. As such, one needs to acquire one. The Lattice screen editor is a pretty decent choice.



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The editor is actually pretty sophisticated, and has obviously been designed to create programs rather than prose. It's blindingly fast, allowing one to scoot from one end of a large file to the other end in less time than it takes most word processors to figure out what you've commanded them to do. One can move in smaller increments ranging from a single character to lines to whole pages. There are niceties like block manipulations and keyboard macros. The macros can be saved to a disk file, so you can have them on line each time you boot the thing.

There's also an on line help feature.

The editor, as is the case with the rest of the compiler package, is clearly intended to be used from the CLI rather than by clicking its icon. You can actually use it from the WorkBench, but the compiler itself requires command line arguments. If you do elect to be reasonable and use the command line you can specify the file name the thing is to edit and a number of useful options about how things are to look when the editor is booted.

One of the command line options invokes a supremely slick feature of the editor and its attendant C compiler. If you have attempted to compile a program which had a few syntactical gremlins in it the compiler will generate an error file. The editor, upon being booted to fix the bugs can inhale the error file and will thereupon show you where the errors exist in your source file. This is so much more high tech than frantically scribbling down line numbers as error messages scream by on the tube.

Perhaps the nastiest bit about buying a new editor is that one needs unlearn all the commands one has become used to on one's old editor... sob. This is mostly not the case with the Lattice screen editor, which comes with an installation utility that permits one to redefine the keys that invoke every function in the program. This means that you can make the editor behave like just about any text editing program you want it to. It comes set up a lot like WordStar.

The oft referred to Lattice C compiler for the Amiga is a really tight bit of work, one which most programmers of the system will walk on air for weeks over. It's fast, apparently bug free and a complete implementation of Kernighan and Ritchie C in all its splendour. It supports floats, double floats and long floats, as well as all the simpler storage classes, `typedef`'s, struct passing and all the other things that lesser compilers tend to leave out. It has sophisticated memory allocation functions, powerful file handlers and a very rich library of functions.

The only catch in using the Amiga C compiler is that you will absolutely have to have the Intuition manual I mentioned above, and you may want the other two books. The documentation for the compiler

is complete... but only so far as one needs it to be to run the compiler itself.

## Green Apples

The Lattice MacLibrary package is a peculiar bit of code. It's a linkable C library which lets one make Intuition calls couched as Macintosh finder calls. In other words, one can use the syntax that one would if one were writing in C on the Mac.

This is, of course, most strange. The Mac's system... especially when translated into C... is none too easy to deal with. Unless you're already well steeped in Mac code I think I'd pass on this one. There are a number of things that it'll do for you that aren't native to the Amiga's system, but the need to mentally switch between two decidedly different calling rationales will probably do in your brain.

If you have written in C for the Macintosh, on the other hand, this thing is moderately useful. It only covers the QuickDraw and sound facilities of the system, but it does a fairly decent job of this.

Included in the library are all the bits for working with points, rectangles, text and patterns. There are also Amiga style window and gadget handlers, plus some low

level initialization things. There is also a fairly comprehensible sound interface and a small selection of miscellaneous routines. My favourite of this last group is called *Munger*... I can think of few practical uses for it, but the name is so neat.

In looking at the documentation for this package, I'd have a hard time deciding whether someone without any experience of programming the Mac could use it on the Amiga as it stands. The alternative, of course, is to acquire a copy of the voluminous *Inside Macintosh*... now also published by Addison-Wesley, by the way... but this is a bit extreme. The simple drawing routines are pretty straight up, but things like *MapRect*... which maps a rectangle into a screen, or so the book says... do seem to beg some further explanation if one is to make full use of it.

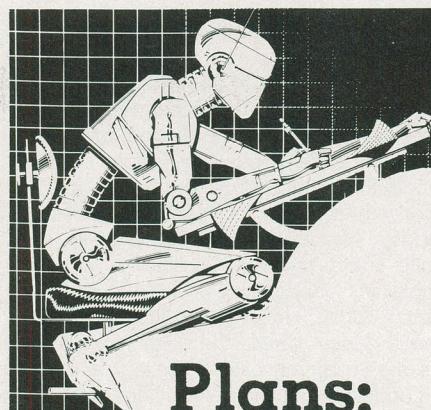
I confess that for the first few things I wrote for the Amiga in Lattice C I used this library quite extensively. It's a comfortable crutch if one doesn't want to be zapped by the whole immensity of the Amiga's system all at once.

## Crunch That Mouse

I haven't had anything like enough time to fully explore the Amiga at the level of Lattice C. There's an incredible amount of stuff one can do... it's a definite strain on the imagination just fathoming it all. However, I can think of nothing I'd rather have to do it with than Lattice C and the Amiga books.

There are a number of other Lattice packages for the Amiga, by the way. These include several text manipulation utilities and another Maclibrary style affair, this one to permit one to deal with the Amiga as if it were dBASE III... oh, horrors. There's also a spreadsheet called Unicalc. I haven't checked out any of them. The compiler was quite enough for one day.

SNI



## Plans:

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**Manufacturer:** Lattice Incorporated

**Availability:** Software Commodities, 334 King Street East, Toronto, Ontario M5A 1K8, telephone (416) 865-1600  
**List Price:** \$215.00

**Software:** Lattice Screen Editor  
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**Books:** Amiga Technical Reference series  
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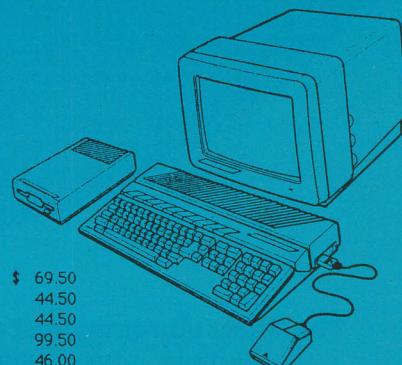
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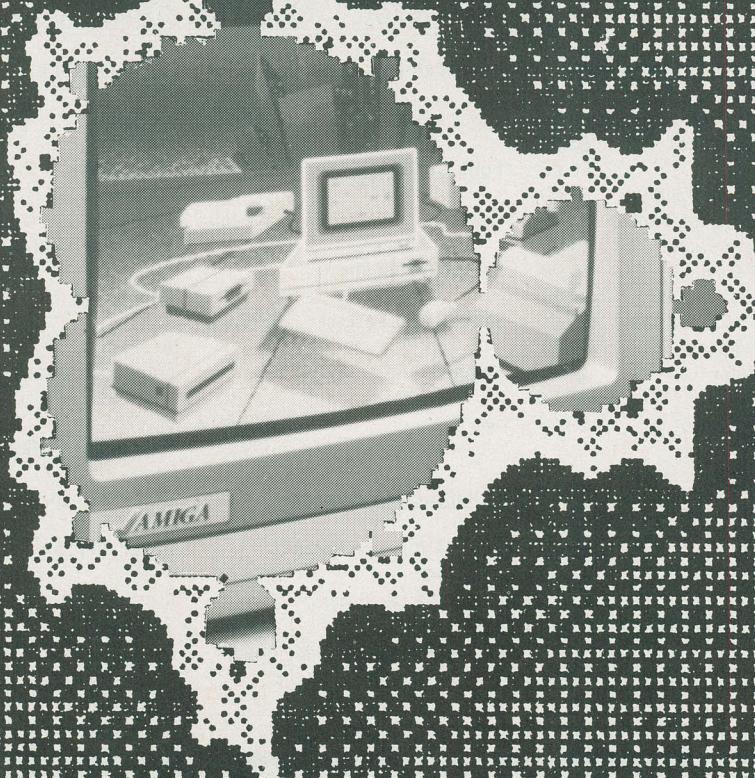
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# MandelZoom for the Amiga



The Mandelbrot microscope has been fascinating programmers for demis eons now... ever since it turned up in the backwaters of Scientific American. Here's an implementation of it in the Commodore Amiga's rather spectacular BASIC that will let you check out the pictures... even if you don't know a fractal from a fraction.

by Steve Rimmer

## MandelZoom for the Amiga

It's hard to say why MandelZoom programs are so interesting. To be sure they produce first class pictures, admittedly of nothing ever seen in this dimension. They represent an interesting programming challenge, making the computer work with numbers that don't really exist. However, I think I like them predominately because they spend so much time probing into stuff that's basically quite spooky.

It makes one's soul sing to find something unexpected buried in the fabric of an otherwise ordered universe.

Should you have thus far failed to become engrossed in fractals and all their peculiarities, you might want to check out the side bar that accompanies this story to get a handle on what they're all about. The important aspect of fractals, however, as far as this program goes, is that they can be handled in BASIC and create very nice pictures on the screen of an Amiga.

### Zooming In

There are a number of things which one must consider in writing a useful Mandelbrot Microscope. Most of these have to do with speed, the remainder being involved with some of the niceties of handling the display of what one turns up.

The process of deciding which points in the complex number plane lie in the Mandelbrot set and... most interestingly, which ones lie just outside it, these being the visually attractive ones... is very involved and very slow. Obviously we can't iterate the points out to infinity. In this case we'll use fairly finite iteration counts, like twenty or forty for most plots. Even still, if we choose to plot the set on a relatively small increment between the points a single pass can take an hour or so.

This version of the microscope, then, allows for the less than spectacular speed of BASIC by providing one of the things that the users of more conventional microscopes have taken for granted for ages, to wit, a focus control. Obviously, if we take any given fraction of the Mandelbrot set and plot it, the time involved will be determined by the number of points in the set we actually choose to plot. Spacing the points out a bit will allow us to clip through the plot in less time, although it avails us of a coarser plot.

In this microscope, then, you can look around the fractal set with the microscope set to render a quick, coarse plot and, when you've found something that might be interesting you can turn up the resolution to produce a more detailed picture.

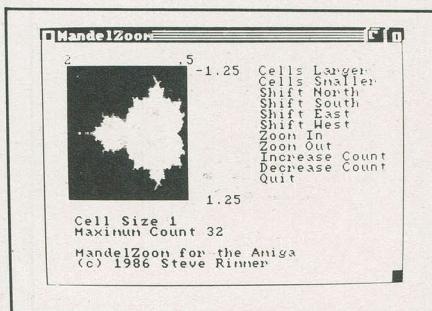
A coarse plot, with everything cranked down to its minimum setting, usually takes fifteen or twenty seconds. This is variable, as the program stops iterating points which clearly aren't in the set as soon as this becomes apparent. Thus, if you happen to have the "window" of the microscope plac-

ed over an area of the fractal set which has lots of points in the set the plot will take significantly longer.

The other important thing about this program is its display. The numbers returned from the iteration process are what ultimately get plotted to generate fractals. What one does with them largely determines how attractive the pictures will look.

One of the Amiga's more inspiring features is its ability to manage its colours. Under BASIC, one can specify thirty-two unique colours at any one time by the use of the PALETTE statement. Each colour can consist of any proportion of red, blue and green.

I've set up two ways of handling the colour in this program... the way that you choose will be determined by the setting of



the variable *TenScale*. If it's false, the program will produce a graduated scale from near white to dark purple. If it's true, it will use a ten step scale with each step represented by a colour. The colours are

- 0 Black
- 1 Brown
- 2 Red
- 3 Orange
- 4 Yellow
- 5 Green
- 6 Blue
- 7 Purple
- 8 Grey
- 9 White

Electronic heads will recognize this as being the RETMA resistor colour code. It doesn't produce a very pretty looking plot, but it does make the areas of the resulting fractals very easy to pick out. I'd pop for the graduated purple scale, however.

The actual fractal plotting part of the program is really rather small, consisting largely of the routines *LookFractal* and *CheckDot*. Virtually all of the rest of the program handles either the display or the rather elaborate mouse interface.

When you first run the program it will start plotting the whole fractal set at a moderate resolution level. Clicking the mouse over one of the options at the right hand side of the screen will cause it to stop plotting, adjust the parameter that has been zapped and restart the plot. In general, the size and position parameters get adjusted in increments directly proportional to the size

### MandelBrot And His Microscope

The program in this article is interesting in that it generates some rather attractive abstract art and, if you're a bit imaginative, may give you cause to wonder how something as precise as pure math can render images that look so organic. The theory behind the program will probably be secondary. However, should you wish to know what it's all about you might want to dig through this sidebar.

Fractal theory has been described as being one of the most complex areas of higher mathematics. This could be a marginal pun, I suppose. It involves a lot of number dancing that doesn't make in purely concrete terms, and gets into some pretty intense calculations.

The images generated by "MandelZoom" programs, or "Mandelbrot Microscopes", are the result of plotting sections of a particularly anomalous area of the complex number plane. You may remember something about complex numbers from high school. The really esoteric mathematicians are still speculating about the meaning of all this.

Let's get into a bit of numerology for a second. Real numbers will be familiar to just about everyone, especially if you've ever tried to program in Pascal, where real is a data type. The numbers we normally use, boring old floating point values, are what the heavy academic heads call "real".

Imaginary numbers are a bit harder to get around. An imaginary number is a real number multiplied by  $i$ ... where  $i$  is the square root of -1. If you whip out your trusty calculator or click the appropriate icon on your system you'll probably find that there's no real value that, when squared, will equal -1. That, of course, is why it's called imaginary.

Despite the fact that we don't know what the value of  $i$  is, we can use it algebraically by keeping it as a constant.

A complex number is an expression with a real and an imaginary part, for example

$$4 + (6 * i)$$

In this case, the real component is four and the imaginary one is six. The value four is implicitly multiplied by the square root of positive one, which is just one.

If one allows that imaginary numbers, just like real ones, can be expressed as quantities along an axis, it isn't hard to see complex numbers as the intersection of two axes, leaving one with a plane of infinite size. At a given area on this plane the numbers begin to behave in a most peculiar manner... it's this bit that contains the Mandelbrot set.

The weird bit of the complex number plane is contained roughly between the real values of -2 and .5 and the imaginary values of -1.25 and 1.25. I couldn't say why.

The thing that makes these complex numbers interesting is how they behave when they're subjected to a particular mathematical process. The expression involved is

$$z^2 + c$$

where  $z$  is a variable complex number and  $c$  is a specific complex number.

If we start to play with this, we can see how the iterative process of the procedure works. Let's start with  $z$  being equal to zero.

## MandelZoom for the Amiga

```

Mandelbrot Microscope for the Commodore Amiga
Generates fractals and other weird purple phenomena

Copyright (c) 1986 Steve Rimmer
Probably not suitable for use on mechanical adding machines

ScreenWide = 100      'width of fractal screen
ScreenDeep = 97       'depth of fractal frame
ScreenLeft = 28       'left side of fractal frame
ScreenTop = 17        'top of fractal frame

CellUp = 3            'line numbers for options
CellDown = CellUp + 1
North = CellDown + 1
South = North + 1
East = South + 1
West = East + 1
ZoomIn = West + 1
ZoomOut = ZoomIn + 1
CountUp = ZoomOut + 1
CountDown = CountUp + 1
QuitLine = CountDown + 1

CellSize = 4          'initial size for cells

false = 0
true = NOT false

ScaleLim = 31         'initial size of colour scale
TenScale = false      'set true for resistor colour code scale

DEF FNormZ(r,i) = SQR((r*r)+(i*i))
DEF FNtrunc(i) = (INT(i * 1000))/1000

LowReal = -2          'initial values for limits of plot
HighReal = .5
LowImag = -1.25
HighImag = 1.25

MaxExp = 4            'initial value for highest count
MaxCount% = 2 ^ MaxExp
Optline = 24           'horizontal option position
Argline = 17           'where numeric arguments show up

CLS
SCREEN 1,320,200,5,1  'set up screen
WINDOW 2,"MandelZoom", (2,2)-(295,180),15,1
GOSUB SeeArgs          'show all numeric args
GOSUB SetColour         'set up colour palettes
GOSUB SetScale          'get scale values
GOSUB SetupBox          'show box
GOSUB SetupOptions       'get options to screen
GOSUB LookFractal        'and... finally... do the deed
BEEP: BEEP: BEEP        'say done
WHILE NOT MOUSE(0) : WEND
GOSUB EndRun             'restore screen
END

SeeArgs:               'show the numeric values on the screen
LOCATE 2,2 : PRINT FNtrunc(LowReal)
LOCATE 2,14 : PRINT FNtrunc(HighReal)
LOCATE 3,17 : PRINT FNtrunc(LowImag)
LOCATE 15,17 : PRINT FNtrunc(HighImag)
LOCATE Argline,4 : PRINT "Cell Size" CellSize
LOCATE Argline + 1,4 : PRINT "Maximum Count" MaxCount%
LOCATE Argline + 3,4 : PRINT "MandelZoom for the Amiga"
LOCATE Argline + 4,4 : PRINT "(c) 1986 Steve Rimmer"
RETURN

SetupBox:              'show the box frame
LINE (ScreenLeft,ScreenTop)-STEP(ScreenWide+CellSize,ScreenDeep+CellSize),ScaleLim,BF
LINE (ScreenLeft-1,ScreenTop-1)-STEP(ScreenWide+1+CellSize,ScreenDeep+1+CellSize),,B
RETURN

```

Zero to the power of two is zero, leaving just  $c$ . Slapping this into the place of  $z$ , we get

$$c^2 + c$$

Sticking this back into the expression... again... we get

$$(c^2 + c)^2 + c$$

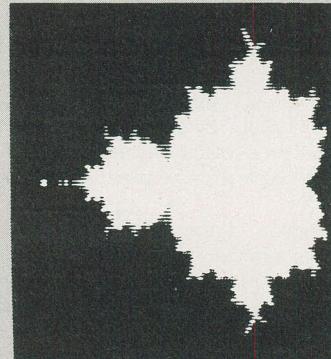
and so on.

If you do this in most areas of the complex number plane the process will continue indefinitely with the numbers moving off toward infinity. However, certain values... those within the Mandelbrot set... behave peculiarly.

To plot the entire Mandelbrot set one would take each point within the area I specified above... choosing a suitable interval between them... and iterate it out through this process. The Mandelbrot set is the set of all the complex numbers which can remain finite after an infinite number of passes through it.

In practice, we don't have a suitably large chunk of infinity to test numbers like this, so we choose an arbitrary high count value. If the number is still finite after it has been iterated this number of times it's considered to be a member of the set.

A Mandelbrot Microscope is a program which lets one "zoom in" on the fractal set or some part of it. Seen as a whole, the set looks like a bulbous, pear shaped sack of cats or, as quite a number of people have noted, a bit like a pair of buttocks. Hey, it wasn't my idea... I thought it looked like a flower.



It's important to note that whereas this picture is generated by a printing press, and zooming in on it will render merely paper fibres, the fractal set is purely mathematical. As such, we can zoom in on parts of it, that is, make the area that we plot smaller, and get just as detailed pictures of what's happening over a portion of the set. The process is theoretically infinite... you can zoom in forever... although there is a practical limit by the precision of the floating point package on the computer generating the plot.

In fact, the actual Mandelbrot set isn't terribly interesting to look at. The really slick bits are those around the edges of it. The disturbance in the complex number plane caused by the Mandelbrot set's presence is what is responsible for the amazingly varied pictures that one associates with this phenomenon.

## MandelZoom for the Amiga

```
SetupOptions:  'show options menu
LOCATE CellUp,Optline : PRINT "Cells Larger"
LOCATE CellDown,Optline : PRINT "Cells Smaller"
LOCATE North,Optline : PRINT "Shift North"
LOCATE South,Optline : PRINT "Shift South"
LOCATE East,Optline : PRINT "Shift East"
LOCATE West,Optline : PRINT "Shift West"
LOCATE ZoomIn,Optline : PRINT "Zoom In"
LOCATE ZoomOut,Optline : PRINT "Zoom Out"
LOCATE CountUp,Optline : PRINT "Increase Count"
LOCATE CountDown,Optline : PRINT "Decrease Count"
LOCATE QuitLine,Optline : PRINT "Quit"
RETURN

Restart:      'reset everything for new plot
CLS
GOSUB SetScale
GOSUB SetupOptions
GOSUB SetupBox
GOSUB SeeArgs
Fx% = ScreenWide : Fy% = ScreenDeep : PlotFractal = true
RETURN

CheckMouse:   'see where the mouse has been clicked
Mx = INT(1MOUSE(1) / 8) + 1 : My = INT(1MOUSE(2) / 8) + 1
IF Mx < Optline OR Mx > Optline + 16 THEN RETURN
IF My = CellUp AND CellSize <= 10 THEN CellSize = CellSize + 1 : GOSUB Restart
IF My = CellDown AND CellSize > 1 THEN CellSize = CellSize - 1 : GOSUB Restart
IF My = CountUp AND MaxCount% <= 1024 THEN MaxExp = MaxExp + 1 : MaxCount% = 2 ^ MaxExp : GOSUB Restart
IF My = CountDown AND MaxCount% >= 4 THEN MaxExp = MaxExp - 1 : MaxCount% = 2 ^ MaxExp : GOSUB Restart
IF My = North THEN GOSUB GoNorth
IF My = South THEN GOSUB GoSouth
IF My = East THEN GOSUB GoEast
IF My = West THEN GOSUB GoWest
IF My = ZoomIn THEN GOSUB GoZoomIn
IF My = ZoomOut THEN GOSUB GoZoomOut
IF My = QuitLine THEN GOSUB EndRun : PlotFractal = false: END
WHILE MOUSE(0) : WEND
RETURN

GoZoomIn:     'zoom in
t = ((HighImag - LowImag) / ScreenDeep) * CellSize
LowImag = LowImag + t
HighImag = HighImag - t
t = ((HighReal - LowReal) / ScreenWide) * CellSize
LowReal = LowReal + t
HighReal = HighReal - t
GOSUB Restart
RETURN

GoZoomOut:    'zoom out
t = ((HighImag - LowImag) / ScreenDeep) * CellSize
LowImag = LowImag - t
HighImag = HighImag + t
t = ((HighReal - LowReal) / ScreenWide) * CellSize
LowReal = LowReal - t
HighReal = HighReal + t
GOSUB Restart
RETURN

GoNorth:      'move frame north
t = ((HighImag - LowImag) / ScreenDeep) * CellSize
LowImag = LowImag + t
HighImag = HighImag + t
GOSUB Restart
RETURN

GoSouth:      'move frame south
t = ((HighImag - LowImag) / ScreenDeep) * CellSize
LowImag = LowImag - t
HighImag = HighImag - t
GOSUB Restart
RETURN

GoEast:       'move frame east
t = ((HighReal - LowReal) / ScreenWide) * CellSize
LowReal = LowReal + t
HighReal = HighReal - t
GOSUB Restart
RETURN
```

of the cells. As such, if you have the cells set coarse, to generate a fast plot, zooming in and out or moving the window will cause things to jump in larger steps.

### Practical Applications

After giving the matter a lot of thought, I can't really come up with anything this program is good for outside of personal amusement. As such, it seems ideally suited for the Commodore Amiga, one of the most amusing computers in the real world. That's as opposed to the imaginary world, as I can't quite conceive of what the square root of a negative Amiga would look like. Possibly a Macintosh.

An interesting aspect of the Amiga's BASIC is that, despite its lack of line numbers, it's very much like the more traditional Microsoft BASIC implementations one finds on the IBM and other, less exciting computers. As an experiment I ported this program over to a PC and numbered its lines. With relatively little effort it ran there too... although no where near as colourfully.

**Stray bits:** The source of most of the interest in MandelZoom programs was an article published in the August 1985 edition of *Scientific American...* you might want to check it out for some of the more complex aspects of the math involved.

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## MandelZoom for the Amiga

```

t = ((HighReal - LowReal) / ScreenWide) * CellSize
LowReal = LowReal + t
HighReal = HighReal + t
GOSUB Restart
RETURN

GoWest:      'move frame west
t = ((HighReal - LowReal) / ScreenWide) * CellSize
LowReal = LowReal - t
HighReal = HighReal - t
GOSUB Restart
RETURN

SetScale:      'set up scaling factors
rScale = (HighReal - LowReal) / ScreenWide

Mandelbrot Microscope for the Commodore Amiga
Generates fractals and other weird purple phenomena

Copyright (c) 1985 Steve Rimmer
Probably not suitable for use on mechanical adding machines

ScreenWide = 180      'width of fractal screen
ScreenDeep = 97       'depth of fractal frame
ScreenLeft = 28       'left side of fractal frame
ScreenTop = 17        'top of fractal frame

CellUp = 3            'line numbers for options
CellDown = CellUp + 1
North = CellDown + 1
South = North + 1
East = South + 1
West = East + 1
ZoomIn = West + 1
ZoomOut = ZoomIn + 1
CountUp = ZoomOut + 1
CountDown = CountUp + 1
QuitLine = CountDown + 1

CellSize = 4          'initial size for cells

false = 0
true = NOT false

ScaleLim = 31         'initial size of colour scale
TenScale = false      'set true for resistor colour code scale

DEF FNorm%(r,i) = SQR((r*r)+(i*i))
DEF FNTrunc(i) = (INT(i * 1000))/1000

LowReal = -2          'initial values for limits of plot
HighReal = .5
LowImag = -1.25
HighImag = 1.25

MaxExp = 4            'initial value for highest count
MaxCount% = 2 ^ MaxExp
Optline = 24           'horizontal option position
Argline = 17           'where numeric arguments show up

CLS
SCREEN 1,320,200,5,1  'set up screen
WINDOW 2,"MandelZoom", (2,2)-(295,180),15,1
GOSUB ReadArgs         'show all numeric args
GOSUB SetColour        'set up colour palettes
GOSUB SetScale          'get scale values
GOSUB SetupBox          'show box
GOSUB SetupOptions      'get options to screen
GOSUB LookFractal       'and... finally... do the deed
BEEP: BEEP: BEEP        'say done

NEXT x
RETURN

' this data sets up the resistor colour code scale
DATA 0,0,0
DATA .8,.6,.53
DATA 1,.6,.67
DATA 1,.73,0
DATA 1,1,.13
DATA .33,.87,0
DATA .4,.6,1
DATA .8,0,.93
DATA .73,.73,.73
DATA 1,1,1
iScale = (HighImag - LowImag) / ScreenDeep
RETURN

EndRun:             'restore amiga's defaults
BEEP : BEEP : BEEP
PALETTE 0,.4,.6,1
PALETTE 1,1,1,1
PALETTE 2,0,0,0
PALETTE 3,1,.73,0
SCREEN CLOSE 1
WINDOW CLOSE 2
RETURN

LookFractal:        'this is where the actual plotting takes place
PlotFractal = true
WHILE PlotFractal
  FOR Fy% = 0 TO ScreenDeep STEP CellSize
    FOR Fx% = 0 TO ScreenWide STEP CellSize
      cReal = LowReal + rScale * Fx%
      cImag = HighImag - iScale * Fy%
      GOSUB CheckDot .
      GOSUB PlotDot
      IF MOUSE@ THEN GOSUB CheckMouse
      NEXT Fx%
    NEXT Fy%
  WEND
RETURN

CheckDot:            'this routine iterates each point
c% = 0 : zR = 0 : zI = 0
WHILE c% < MaxCount% AND FNorm%(zR,zI) <= 2
  t = (zR*zR) - (zI*zI) + cReal
  zI = 2 * zR * zI + cImag
  zR = t
  c% = c% + 1
WEND
RETURN

PlotDot:             'this routine plots the dot (or rectangle)
c = INT((c% / MaxCount%) * (ScaleLim-1))+1
IF CellSize = 1 THEN PSET (ScreenLeft + Fx%, ScreenTop + Fy%),c
IF CellSize > 1 THEN LINE(ScreenLeft+Fx%, ScreenTop+Fy%)-STEP(CellSize-1,CellSize-1),c,BF
RETURN

SetColour:           'initialize the screen palettes
IF NOT TenScale THEN GradScale
  FOR x = 1 TO 10
    READ r,g,b
    PALETTE x,r,g,b
  NEXT x
  ScaleLim = 10
  RETURN
GradScale:
  FOR x=1 TO ScaleLim
    PALETTE x,(x/ScaleLim),0,(x/ScaleLim)

```

# Almost Free PC Software

## Volume 8

This is another collection of fairly large applications. We've had to spread them over two disks. However, the extra three bucks is nothing compared to the power of some of this software. Whether you're interested in games, business applications or code hacking, you'll find something of interest in this larger than usual collection of programs. In addition to the programs themselves, the set includes all the support files needed to use them.

**Load-Us** allows users of the popular Lotus 1-2-3 and Symphony programs to run them on a hard drive. It isn't a cracking program, but, rather, a preboot to avoid the inconvenience of this copy protected software for legitimate users.

**DDCal** is a very clever perpetual calendar and desk diary. It keeps track of your appointments and performs several other functions that you probably thought could only be done on the backs of match books.

**PC Key Draw** is the remarkable public domain paintbox program which blows away so many commercial applications. It'll handle multiple screen images, business graphics and superb computer art...all in full colour. It's worth the cost of this package all by itself.

**CPU** is a tiny program to tell you the effective speed of your system.

**Xray** is a remarkable co-resident utility to monitor what a program is doing while it's busy doing it. It allows you to interrupt the execution of your code and have a look inside.

**Game**...well, there are no words for this program, or, at least, none that are printable. This game is a bit rude... depending on just how weird your mind is, it can get pretty bizarre. This program does use some suggestive language, and we recommend that young or sensitive users not boot it.

**Tune** is a very small music generator to make noises from within batch files. It's useful to see where things are in a complex process.

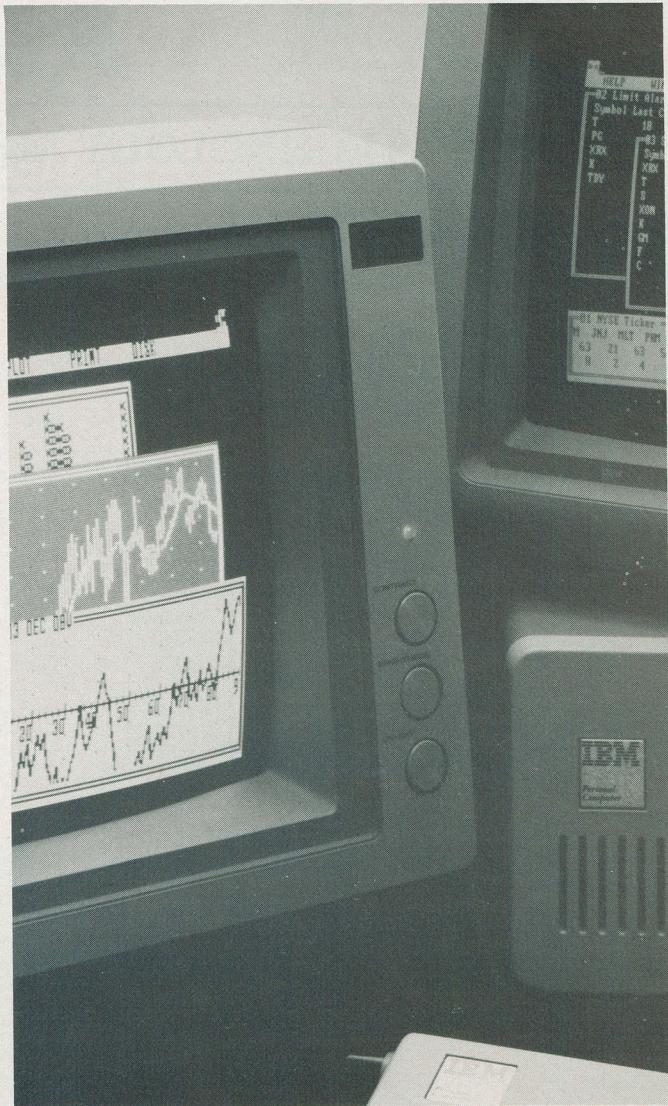
**Chasm**, or cheap assembler, is just the thing if you want to get into assembly language programming but don't want to spring for the Microsoft macro assembler package. It's reasonably fast, not too huge... it'll run in as little as sixty-four kilobytes... and, above all, cheap.

**Getdir** is a resident directory utility. It allows you to see what's happening on your disks even if you're in the middle of doing something else.

**CopyPC**, not to be confused with the commercial Copy II PC, is a quick disk backup utility for the IBM.

**Lookit** is a full screen browsing program to let you scroll forward and backwards through text files... a sort of a tiny word processor that can't edit anything.

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| Standard RAM                               | 512K               | 256K                 | 512K                 | 256K                |
| Number of Keys                             | 95                 | 95                   | 59                   | 85                  |
| Mouse                                      | Yes                | No                   | Yes                  | No                  |
| Screen Resolution<br>(Non-interlaced Mode) |                    |                      |                      |                     |
| Colour<br>Monochrome                       | 640x200<br>640x400 | 640x200<br>720x350** | None<br>512x342      | None<br>640x352     |
| Colour Output                              | Yes                | Optional             | None                 | Optional            |
| Number of Colours                          | 512                | 16                   | None                 | 16                  |
| Disk Drive                                 | 3.5"               | 5.25"                | 3.5"                 | 5.25"               |
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# The Labours of Hercules



The popular Hercules graphic card for the IBM PC is a joy to use, rendering almost Macintosh-like pictures on a stock IBM. Writing graphics software for it, on the other hand, can be a bit frustrating at first. Suitable code awaits.

by Steve Rimmer

I have a box of old IBM PC peripheral cards that gets bigger all the time. It's actually quite disturbing... there's some very expensive technology in there providing a comfortable home for a lot of dust I don't feel any responsibility toward. One of the most notable residents of this particular carton is the colour card that came with my PC.

There's a Hercules card plugged in the slot it used to occupy and, while one occasionally finds need to swap them back for a while, I resist it whenever I can. The image generated by the Hercules card is much easier to look at, being crisp, steady and somehow more technological looking than the controlled fuzziness that PCs are usually noted for.

The only drag inherent in the Hercules card is that higher level languages just don't come with an interface for Hercules graphics... even if you happen to be using something that would normally do some colour card graphics, it won't work on the Hercules board, which locates its screen in a wholly different place. Furthermore, creating Hercules card images isn't all that easy, as the parameters one uses to peek and poke the screen are slightly different from those of the more common video display adapters.

In this article we're going to look at how one makes the Hercules card draw pictures. The programs here are written, for the most part, in Datalight C, but they'll run with little or no hassle under other C compilers. The techniques I've used in them are simple enough, and can be applied to other languages.

## The Modes

The Hercules card has three basic modes, of which we're interested in the first two. In its primary mode it emulates any other

## Labours of Hercules

eighty column screen that one might normally plug into the PC. It looks to such software as cares to look like an IBM monochrome display adapter. The first four of its sixty-four kilobytes of memory are used to hold characters and their attributes.

When it first comes up the Hercules card can run pretty well any text oriented software one would normally pop into a PC.

The system's graphics mode is quite a bit different from that of the standard IBM hardware. To begin with, there are no colours available... obviously. One can only set the pixels on or off. However, the horizontal resolution, at seven hundred and twenty pixels across, is rather better than that of the PC's regular display. The vertical resolution is three hundred and forty-eight lines.

This amounts to there being almost thirty-two kilobytes of memory to drive the Hercules card's screen. In fact, the card holds sixty-four kilobytes, as it has two pages of screen memory. The first page starts at offset zero of memory segment OB000H, as does the memory for the IBM monochrome display card. The second one starts at the beginning of segment OB800H, just like that of the colour card. That third mode that I mentioned a while ago allows one to have a colour card in the system with a Hercules card, by the way... it suppresses the Hercules card's second page. This isn't quite as useful as it sounds, however, as any software which goes to check which card is in the system will see only the Hercules board and won't initialize... or usually even write to... the colour card.

We're only going to be concerned with the first two modes here and the first of the Hercules card's screen memory pages.

The basis of the Hercules card's video display is the same chip as one finds in almost every other video display made in the last few years, to wit, the 6845 chip. It also drives the colour card, for example. However, the Hercules card sees it nestled in the middle of some rather more sophisticated circuitry and programmed with a different set of parameters.

The fact of the 6845's appearance in so many differing screen displays suggests that how it behaves is largely a factor of the software that drives it. Changing modes on the Hercules card is mostly a matter of stuffing new values into the registers of this chip. The registers are accessible through PC ports, which, in turn, can be read from and written to by machine language IN and OUT instructions.

The procedure for changing the modes on the Hercules card is peculiar but not terribly difficult... at least, not once you have the code. However, Datalight C lacks any built in way to communicate with the PC's ports. Furthermore, this sort of code is cumbersome in C, while it's fairly easily handled in assembly language. Therefore,

```
; MACHINE LANGUAGE MODULE TO INITIALIZE HERCULES CARD FROM DATALIGHT C
```

```
DGROUP      GROUP   DATA
DATA        SEGMENT WORD PUBLIC 'DATA'
ASSUME DS:DGROUP

; DATA TO SET SEXT MODE IN HERCULES CARD
TTABLE       DB      61H,50H,52H,0FH,19H,06H,19H,19H,02H,0DH,08H,0CH

; DATA TO SET GRAPHICS MODE IN HERCULES CARD
GTABLE       DB      35H,2DH,2EH,07H,58H,02H,57H,57H,02H,03H,00H,00H

DATA        ENDS

PGROUP      GROUP   PROG
PROG        SEGMENT BYTE PUBLIC 'PROG'
ASSUME CS:PGROUP

PUBLIC    graphics_mode, text_mode

graphics_mode: PUSH  ES
              PUSH  DS

              MOV   DX,0JBFH
              MOV   AL,1
              OUT  DX,AL

              MOV   AL,2
              MOV   SI,OFFSET TTABLE
              MOV   BX,0
              MOV   CX,4000H
              CALL  HERC_MODE
              POP   DS
              POP   ES
              RET

text_mode:  PUSH  ES
              PUSH  DS

              MOV   DX,03BFH
              MOV   AL,0
              OUT  DX,AL

              MOV   AL,20H
              MOV   SI,OFFSET GTABLE
              MOV   BX,720H
              MOV   CX,2000H
              CALL  HERC_MODE
              POP   DS
              POP   ES
              RET
```

```
; THIS ROUTINE SETS UP THE MODE FOR THE HERCULES CARD
```

Program one, the card initialization.

## Labours of Hercules

```

HERC_MODE:    PUSH  DS
              PUSH  ES
              PUSH  AX
              PUSH  BX
              PUSH  CX
              MOV   DX,3B8H
              OUT   DX,AL
              MOV   AX,DS
              MOV   ES,AX
              MOV   DX,3B4H
              MOV   CX,12
              XOR   AH,AH
              MOV   AL,AH
              OUT   DX,AL
              INC   DX
              LODSB
              OUT   DX,AL
              INC   AH
              DEC   DX
              LOOP  HERC_MODE1
              POP   CX
              MOV   AX,0B000H
              CLD
              MOV   ES,AX
              XOR   DI,DI
              POP   AX
              REP   STOSW
              MOV   DX,3B8H
              POP   AX
              ADD   AL,B
              OUT   DX,AL
              POP   ES
              POP   DS
              RET
PROG          ENDS
END

```

**Program one cont'd.**

the first thing one must do is to write an assembly language module for the program to take care of the mode changes. The module is shown here as program one.

The functions of the two principal external callable routines of this module are to set the mode bits in the configuration register, 03BFH, to stuff the appropriate register values into the 6845's registers... they're held in the strings up in the data segment at

```

10 'peekchar  copyright (c) 1986 steve rimmer
20 'generates source for C array containing patterns of
30 'characters @ to 127 copied from ibm pc rom
40 OPEN "O",#1,"c:scrap"
50 DEF SEG = &HF000 'segment for the rom bios
60 CHAR.BASE = &HFABE 'start of patterns... may need fiddling
70 FOR Y=0 TO 127
80     FOR X=0 TO 7
90         A(X) = PEEK(CHAR.BASE + X + (Y * 8))
100    NEXT
110    GOSUB 150
120    NEXT
130 CLOSE
140 END
150 'print source to file scrap
160 PRINT #1,"<";
170 FOR Q=0 TO 7
180 PRINT #1, A(Q);
190 IF Q < 7 THEN PRINT #1, ",";
200 NEXT Q
210 PRINT #1, ">,"
220 RETURN

```

**Program two PEEKCHAR.**

```

/* score program */

#include <stdio.h>
#include <score.h>

#define screen_base      45056 /* +2048 if colour card */
#define screen_wide      720
#define screen_deep      348

/* clefs */
#define treble           1
#define bass             2
#define percussion       3

/* character attributes */
#define normal            0
#define inverse           255

int staff_top,staff_left,staff_len; /* staff position */
int cp_x,cp_y;                      /* character position */
short sc_attr;                      /* video attribute */

main()
{
    int y;
    char c[11];

    graphics_mode();

    staff_top = 100;
    staff_left = 4;

```

**Program three.**

## Labours of Hercules

```
staff_len = 60;

staff(staff_left, staff_top, staff_len);

cleff(treble);

attribute(normal);
position(4,200);
draw_string("Sayth the milkmaid to the miller...");

attribute(inverse);
position(4,210);
draw_string("Get yer 'and off my leg...");

getchar();

text_mode();
}

position(x,y)           /* set character position */
int x,y;
{
    cp_x = x;
    cp_y = y;
}
attribute(a)            /* change current video attribute */
int a;
{
    sc_attr = a;
}

draw_char(c,x,y)        /* draw character c at x,y */
int c,x,y;
{
    int t;

    if (isascii(c) != 0) {
        t = 0;
        while (t < 9) {
            screen_poke(ascii_pattern[c][t] ^ sc_attr, x, y - (7-t));
            ++t;
        }
    }
}

draw_string(s) /* draw string s at current cursor pos */
char *s;
{
    int p,c;
    p = 0;
    while ((c = *(s + p)) != NULL && cp_x < screen_wide) {
        draw_char(c, cp_x, cp_y);
        ++cp_x;
        ++p;
    }
}
```

Program three cont'd.

the top of the code... and finally to clear the screen by filling the appropriate size buffer with zero bytes.

To get this bit of code ready, type it in and assemble it with MASM. Don't link it just now... it'll be linked in its OBJ form to the rest of a larger C program.

The next thing you'll need is a linking batch file to get this thing attached to your C code after it has been compiled. This one assumes that the compiler is on drive A, the source code and the HERCINIT.OBJ modules lives on B and that there's a RAM disk as drive C to hold the temporary files. If you can't get a RAM disk together replace all the C:s with B:s.

```
echo off
echo compiling %1
dlc1 b:%1.c -oc:%1.tmp -ib:
if errorlevel 1 goto exit
dlc2 c:%1.tmp -oc:%1.obj
if errorlevel 1 goto exit
link bcc1 +c:%1.obj+b:hercinit.obj:c:
%1.exe:c:%1.b:nl\map
exe2bin c:%1.exe b:%1.com
exit:
```

I call this thing C.BAT. To use it to compile a program called GRAPHIC.C you would type

### C GRAPHIC

from drive A and then watch the circus.

### Now... The Party

Having dealt with the trivialities of getting the card happy, we can look at the main effort, shown here as program three. This code doesn't do anything terribly useful, but it does illustrate how to work the graphics on the Hercules card so you can write something more productive.

It's conceptually convenient to consider the screen of the Hercules card... when it's been set into its graphics mode... as being an array of pixels. However, in reality it's an array of bytes, with each byte being responsible for eight consecutive pixels. To further complicate things, the odd numbered lines start at an offset of zero into the buffer. The even numbered ones start at an offset of 2000H, or 8192 bytes into the thing.

To set one pixel we would find the byte that holds it and OR on the bit that represents the pixel in question. As one might imagine, this process, while perfectly acceptable to the card, is quite slow, as it involves quite a number of instructions for every dot we want to turn on or off. By comparison, turning on a whole byte worth of pixels requires a single machine language MOV, and very little more at the C language level.

Whereas drawing a horizontal line across the tube one pixel at a time involves a noticeable delay, poking in the ninety bytes that would make it up can be done virtually instantaneously.

## Labours of Hercules

In doing professional looking graphics it's worth trying to handle things at the byte level rather than one pixel at a time. This keeps one's code much simpler, to be sure, and it makes the resulting programs work very much faster.

There are three basic routines that form the heart of this code, these being *screen\_peek()*, *screen\_poke()* and *screen\_over()*. The peek routine is probably the easiest of the three to understand. Given the X and Y co-ordinates of the byte on the screen we're interested in it returns its value.

The co-ordinates we're going to use in this article are all a bit funny. The Y co-ordinates are in increments of a pixel, ranging from zero to three hundred and forty-eight. The X co-ordinates, on the other hand, are in increments of a byte, ranging from zero to ninety.

The formula for finding the byte specified by a set of these co-ordinates is

$$(8192 * (Y \% 4)) + (90 * (Y / 4)) + X$$

The percent sign is the C modulus operator, and decides whether or not to add the 2000H offset for odd numbered lines.

Understanding how the screen peek routine finds bytes, it should be fairly easy to see what the screen poking routine is up to. The *screen\_over()* code may be a bit less fathomable. It overlays the byte given by its first argument on top of the byte on the screen found at the co-ordinates specified by its other two. This uses the C language OR operator.

The most obvious thing to do with these guys is to have them draw some lines. Straight horizontal lines are the easiest... they're handled by *hr\_line()*. This version insists that the lines start and end on even byte increments. However, we could rewrite it to poke in fractional bytes at the beginning and ends of its lines so as to be able to specify them down to the nearest pixel.

Drawing vertical lines is rather more complicated. The *vr\_line* routine here illustrates how one deals with the screen at the pixel level when one must. The *b* argument for this code is the offset into the byte that the line is to be drawn.

It isn't all that hard to devise a universal line drawing routine, one which will handle lines drawn between any two co-ordinates on the screen. However, such a routine would be very much slower than either of these two specialized bits of code. We may look at one in a later article. However, it's especially true in writing PC code... the PC isn't the fastest box in creation... that it is usually preferable to have multiple fast specialized routines than a single much slower general purpose one.

### The Shape Of Things

Often much more useful than drawing lines and other geometric things is creating shapes, or, in Macintosh terminology, icons.

```
}

cleff(c)                                /* place cleff on current staff */
int c;
{
    switch(c) {
        case treble:
            do_shape(staff_left+1,staff_top-8,s_treble_clef);
            break;
        case bass:
            break;
        case percussion:
            break;
    }
}

do_shape(x,y,p)                         /* send shape p to screen at x,y */
int x,y;
short p[48][4];
{
    int s,t,c,d;

    d = (p[0][0]) - 1;
    c = (p[0][1]) - 2;
    s = 0;
    while (s < d) {
        t = 0;
        while (t < c) {
            screen_over(p[s+1][t],x + t,y + s);
            ++t;
        }
        ++s;
    }
}

screen_poke(i,x,y)                      /* poke i to the screen at x,y */
int i,x,y;
{
    char c[1];

    *c = i;
    poke(screen_base,(8192 * (y \% 4)) + (90 * (y / 4)) + x,c,1);
}

screen_peek(x,y)                        /* peek screen at x,y */
int x,y;
{
    char c[1];

    peek(screen_base,(8192 * (y \% 4)) + (90 * (y / 4)) + x,c,1);
    return(*c);
}

screen_over(i,x,y)                     /* overlay i at x,y */
int i,x,y;
```

## Labours of Hercules

```
    screen_poke((screen_peek(x,y) | i),x,y);
}

hr_line(x,y,l)           /* draw line from x,y l long */
int x,y,l;
{
    int t;
    t = 0;
    while (t < l) {
        screen_poke(255,x + t,y);
        ++t;
    }
}

vr_line(x,y,b,l)          /* draw a vertical line x+b,y l long */
int x,y,b,l;
{
    int s,t;
    s = 0;
    while (s < l) {
        t = screen_peek(x,y+s) | (l < 1);
        screen_poke(t,x,y+s);
        ++s;
    }
}

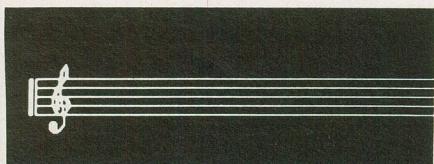
staff(x,y,l)              /* draw staff from x,y l long */
int x,y,l;
{
    int s;
    s = 0;
    while (s < 5) {
        hr_line(x,y + (s * 5),l);
        ++s;
    }

    vr_line(x-1,y,7,21);
}
}
```

Program three, end.

In a more comprehensible sense, we want to map bits onto the screen.

If you were to create an image on the screen, such as this one



by plotting each pixel of it, you'd have a very large tedious program to create a relatively small number of bytes. Furthermore, the process would be rather slow for all the reasons we've just looked at.

As with drawing lines, we can poke bit

mapped images to the screen in very much less time than it would take to plot them. The treble clef in this example pops up just about instantly, and requires relatively little code or data to create.

Yes, I know, it could have been the Mona Lisa... but this is a music issue.

The data for the treble clef is contained in the fourth program in this feature in the array *s\_treble\_clef*. This is a sequence of *short ints*... essentially bytes. The first two bytes represent the depth of the shape and the number of bytes wide it is respectively. The next two bytes are dummies so that the line count comes out right.

Once again, we have to compromise a little as to how we draw this bitmap. If we don't mind its having to be aligned with the

bytes of the screen... that is, the first pixel of the image must rest on an even multiple of eight on the screen... we can poke it into the tube very quickly as a hundred and sixty bytes. The other alternative, drawing it pixel by pixel, requires over twenty-five hundred screen accesses with quite a bit of calculation between each.

The code for creating bit maps on the screen is given here as *do\_shape()*. The argument *p* is a pointer to the array of short integers that holds the bit map values. It will draw a bit map of any size, the dimensions being defined by the first two bytes of the array.

Note that this code overlays bytes to the screen rather than simply poking them there. You can change this and get a bit more speed out of it if you don't care about the screen background... although it's pretty snappy as it is.

### Words And Pictures

One of the things that makes writing programs for the Hercules card in its graphics modes so tricky is its latent inability to display text while it's busy doing pictures. If you try to execute a *puts()* while the screen is occupied with pixels the best you can hope for is some interesting random dots.

Intelligible looking characters... from a graphics point of view... are really just shapes, or really rather pedestrian bit maps. The last thing we'll look at here is a fairly basic text interface for graphics.

If you used a colour card for a while before you got a Hercules display you'll probably have noticed that the PC can mix graphics and text quite painlessly in its graphics modes on a colour card. This is because the PC's ROM has a whole set of character patterns coded into it which the text handling routines can call on if the colour card is in its graphics modes. This is no real help to the Hercules card, as the BIOS doesn't support its graphic mode.

The only potentially horrible part about creating a text interface for the Hercules card's graphics modes is in creating the character patterns... a work of mind numbing tedium at the very least. However, there is a very simple way around this. It's possible to have a very small program... the one in listing two here, in fact, write all the code for us.

In most cases, the character patterns in the ROM BIOS live at offset OFA6EH in segment OF000H. This isn't quite reliable enough that we'd want to have a program use them directly, peeking them out of the ROM and poking them onto the screen, as we might find that such a program wouldn't work on compatible systems with slightly irregular BIOSs. However, we can peek the bytes out of the BIOS and turn them into source code... which is what the PEEKCHAR program does. Run it and it'll leave you with a file called SCRAP that holds perfectly legal C code to generate an

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```

/* ascii character pattern tables */
static short ascii_pattern[128][8] = {

/* insert scrap file produced by PEEKCHAR.BAS here */

};

/* shape element - treble cleff */
static short s_treble_clef [40][4] = {
/* 1st element 40 = depth, 4 = width */
    { 40, 4, 0, 0 },
    { 0, 8, 0, 0 },
    { 0, 24, 0, 0 },
    { 0, 60, 0, 0 },
    { 0, 108, 0, 0 },
    { 0, 204, 0, 0 },
    { 0, 204, 0, 0 },
    { 0, 204, 0, 0 },
    { 0, 204, 0, 0 },
    { 0, 0, 0, 0 },
    { 1, 112, 176, 0 },
    { 1, 224, 0, 0 },
    { 1, 192, 0, 0 },
    { 3, 128, 0, 0 },
    { 0, 0, 0, 0 },
    { 15, 128, 176, 0 },
    { 14, 128, 0, 0 },
    { 28, 128, 0, 0 },
    { 24, 128, 0, 0 },
    { 0, 0, 0, 0 },
    { 51, 252, 176, 0 },
    { 39, 78, 176, 0 },
    { 38, 71, 176, 0 },
    { 38, 71, 176, 0 },
    { 0, 0, 0, 0 },
    { 18, 39, 176, 0 },
    { 25, 38, 0, 0 },
    { 12, 36, 0, 0 },
    { 6, 120, 176, 0 },
    { 0, 0, 0, 0 },
    { 0, 16, 0, 0 },
    { 0, 16, 0, 0 },
    { 0, 16, 0, 0 },
    { 120, 16, 176, 0 },
    { 252, 16, 176, 0 },
    { 252, 48, 176, 0 },
    { 252, 96, 176, 0 },
    { 252, 192, 176, 0 },
    { 121, 128, 176, 0 },
    { 30, 0, 0, 0 }
};

;

```

**Program four, the header file.**

array of character pattern values.

Add the stuff in SCRAP to the shape in the header file in listing four. While you're at it, you should remove the comma after the last curly bracket of the last line. It's almost perfectly legal code.

The first line of the scrap file should be a string of eight zeros, as should the thirty second. If they aren't, it means that the character patterns in your BIOS don't start at 0F000:0FA6EH... you might have to boot up DEBUG and locate them, changing the values at the start of PEEKCHAR.

## Words And Music

Getting back to the text at hand, the bit pattern table... another set of short integers... behaves quite predictably. To print a character all we need is to draw the bit map defined by `ascii_pattern() [n][0 - 7]`, where `n` is the ASCII value in question. You can

The text handling code for this program is centred around `draw_char()`, which will first thirty-two patterns and subtracting thirty-two from every character value you go to print. The first thirty-two patterns correspond to control codes, and are very rarely used.

The text handling code for this program

is centred around `draw_char()`, which will draw the character with ASCII value in its first argument at the co-ordinates given in its next two. Like the shape code of a while ago, it just pokes the appropriate bytes to the screen. The only peculiar bit might be in that it exclusive ORs each byte with a global variable, `sc_attr`. The caret symbol is a bitwise exclusive OR in C.

If you were to take a shape on the screen and flip every pixel, such that all the lit ones went off and all the off ones came on, the result would be to render the picture in inverse video. In logical terms, you can invert a bit by exclusive ORing it with one. You can invert all the bits in a byte by exclusive ORing the byte with two hundred and fifty-five... this being a byte of eight ones.

The routine `attribute()` sets the current screen attribute, `sc_attr`, as either `normal` or `inverse`, these two values being defined constants. If this value is `normal`... which is zero... when `draw_char()` is called, the bytes will be exclusive OR'd with zero, and, as such, not affected. If it's `inverse`... or two hundred and fifty-five... all the bytes will be flipped, and the text will turn up inverted.

There are a few other routines which

are needed for a useable text interface. The first one is `draw_string()`, which takes a pointer to a string as its argument and draws the string using the character drawing code at the current cursor position. The current cursor position... I thought you'd never ask... is set by the `position()` routine.

## Flotsam

While this program doesn't do much besides drawing some interesting stuff on the tube, it embodies most of the principals required to get professional looking stuff happening on the Hercules card. It's a vast shame not to explore the graphics of this slab of fiberglass... it's so invincibly slick and splendid.

As I suggested earlier on, most of this code can be easily redone in Turbo Pascal or any other dialect of your choice. To a large extent it can be handled in BASIC... the bitwise manipulations will want some specialized code... but one runs into the problem in this that if BASIC throws a syntax error while the Hercules card is in its graphics mode you'll have a bit of a time convincing it to leap back into showing you text.

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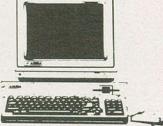
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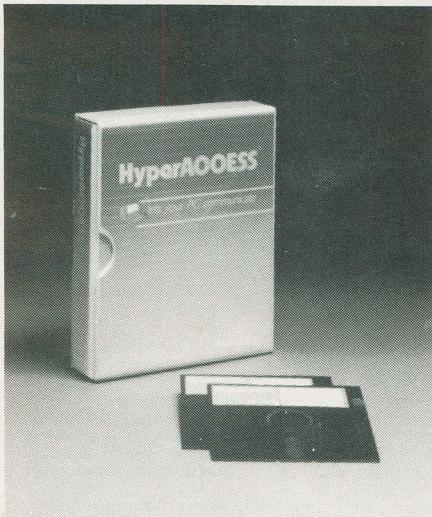
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Continued from page 7

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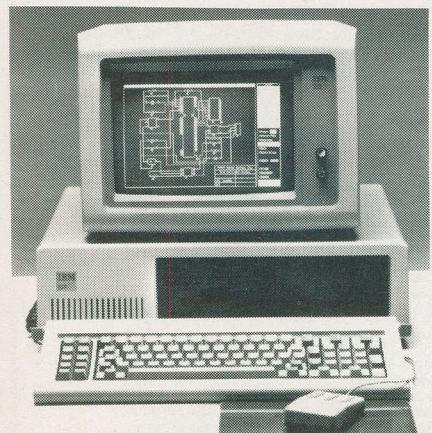
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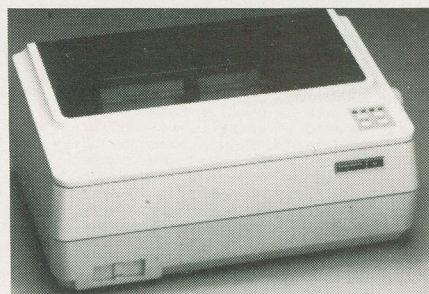
Also available through Genamation, the **Toshiba P321** eighty column printer provides letter quality print at seventy-two characters per second and draft quality at two hundred and sixteen. With both Qume Sprint 11 emulation and IBM Graphics emulation available the P321 has a list price of just under twelve hundred dollars.



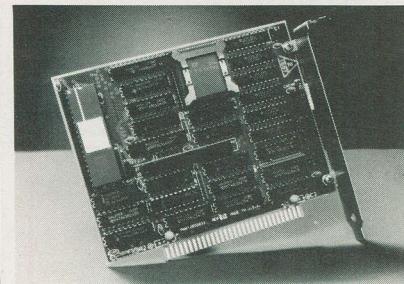
• Available through **Sak Data**, two new **dot matrix printers** from **Mannesmann Tally** feature bi-directional printing, plug in font cartridges and modular interfaces compatible with IBM PC, Epson FX and Apple Imagewriter. Print speeds are 45 cps for near letter quality and 180 cps in draft mode. The regular carriage width MT85 retails for \$749.00, while the wide body model, MT86 has a retail price of \$895.00; these prices include one interface of your choice.

You can reach Sak Data Products at 1590 Matheson Boulevard, Unit 26, Mississauga, Ontario L4W 1J1, or by calling (416) 624-6763.

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MAIL ORDERS: We accept VISA; MC; AMEX; credit cards. Money orders, cheques (2 week wait) are also OK. Minimum packing and handling fee \$5.00 or 5%, whichever is larger. The only COD fees or money orders we accept are from CPO at all. All Ont. res. add 7%. All prices are subject to change without notice. Returns are subject to a 20% restocking charge.

**WIRED CARDS  
FOR IBM**

- (A) 384K RAM CARD. A 1/4 sized card that has 384K of 64K DRAM on board. With OK ..... \$79.95
- (B) 512K RAM CARD. A full sized card with 512K of 64K DRAM on board. With 64K ..... \$119.00
- (C) 576K RAM CARD. A very popular card with 576K of 64K and 256K DRAM on board. This is a 1/4 sized card for portable use. With OK ..... \$79.95
- (D) KRAM RAM CARD. A clone of the JRAM with up to 2 MBYTE on board using 256K DRAM. 100% compatible, complete with software for using as RAMDISC and RAMSPOLL. With OK ..... \$139.00
- (E) COLOR GRAPHICS. A clone of the popular PERSYST color card. Has three outputs and one input. A RGB for IBM color monitor. B Video 1v P to P composite color video. C. Video gray scale 1v P to P for seeing color on green or amber monitor ..... \$129.95
- (F) MONOCHROME GRAPHICS/PRINTER. A workalike clone 100% IBM compatible for the HERCULES card. Has par printer port and hi-res text and graphics mono output ..... \$159.95
- (G) 384K HEXPACK. A copy of the AST 6-PACK, 100% compatible with software. Has Clock/calender/alarm and 384K DRAM and serial and parallel ports and game I/O. With OK ..... \$189.00
- (H) 640K HEXPACK. Similar to above but with 640K on board using 256K and 64K DRAM. All other features the same. With OK ..... \$279.00
- (I) DISC CONTROLLER. For 1-4 DS-DD drives. Full IBM standard with cable and instructions ..... \$79.95
- (J) DISK CONTROLLER + I/O CARD. A very good card that has a clock/calender/alarm and game I/O and serial and parallel ports and a standard 1-2 drive controller card on a full sized card. Very efficient card ..... \$189.95
- (K) I/O + 2. A clone of the very popular USA card of the same name. Has clock/calender/alarm, with game I/O, serial and parallel, ports ..... \$129.95
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- (M) SERIAL CARD. A standard ASYNC serial card for modem use etc. ..... \$49.95
- (N) MODEM CARD. A 300/1200 Baud modem using the 8910 WORLDCARD chip. Compatible with many popular software packages. ..... \$189.00
- (O) 8255 I/O CARD. Uses 2 8255's to give 16 lines of I/O for various uses. Fully locatable ..... \$129.95
- (P) CLOCK CALENDAR CARD. A small card to add the clock/calender/alarm battery to system ..... \$49.94
- (Q) GAME PORT CARD. Adds two std game I/O ports to the system ..... \$39.95

**MEMORY FLASH**

- 64K-200Ns DRAM ..... \$2.00
- 64K-150Ns DRAM ..... \$2.00
- 256K-150Ns DRAM ..... \$5.75
- Set of 941256 ..... \$44.00

**SWITCHING POWER  
SUPPLY**

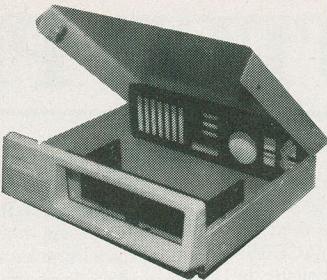
110V, 60Hz with Fan and two  
rear switched outlets

These power supplies fit our cases.  
 130 WATT + 5V - 14A; + 12V - 4.2A; ± 12V - 1/2A  
 Back Switch ..... \$135.00  
 Side Switch ..... \$139.00  
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**IBM CASE**

We have the nicest case of all the various competing cases, ask any friend who has bought someone else's case and then has seen ours. The lid is hinged with pushbutton access. The back is cut for 8 XT slots and it comes with all the case back inserts for cards, card guides, blind disc filer plates, standoffs, feet, screws, all for \$69.95. Please specify back or side cutout for power supply.

We also have an IBM 8 Slot/6502 Board dual duty case for making IBM look-a-like 6502 systems ..... \$79.95

**NICADS 8.4V 7 "D"  
4A.H CELLS**

A great buy, a pack of 7 brand new GE NICADS giving 8.4v at 4 Amp hours. Each cell is 12v and separates easy. Used as 5V backup through a 7805. Gives 5v 1 Amp for 4 hours. .... \$14.95

**IBM COMPATIBLE  
SYSTEMS**

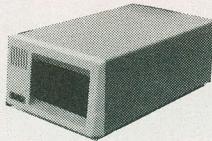
All SME-XT systems share these attributes.

- High order compatibility due to the DTC bios which is recognized superior to others.
- 8 Slots for plug in cards, just like IBM
- Made right here in Canada
- Socketed for the 8087 Co-processor
- IBM compatible serial keyboard
- Disc controller using 9216 IC, the most advanced, for error free operation.
- Properly made 135W power supply with accessory plugs.

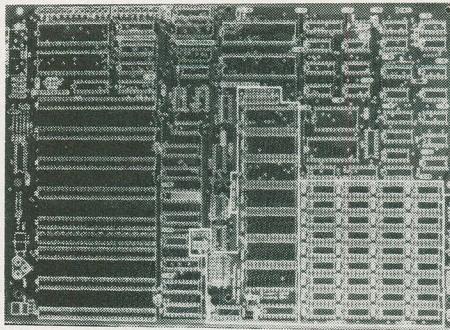
(A) Basic system 256K, 1 DSDD drive, & controller monochrome card, 135W PS and keyboard \$949.00

OPTIONS, Add the amount indicated for the option.

- (1) 640K Motherboard with 640K ..... \$110.00
- (2) Color graphics card with gray scale ..... \$80.00
- (3) Parallel printer port card ..... \$59.00
- (4) Clock, calendar, alarm, serial, parallel, and game card ..... \$110.00
- (5) Extra drive, installed and tested ..... \$160.00
- (6) 10 Meg hard drive, w/controller ..... \$649.00
- (7) 20 Meg hard drive, w/controller ..... \$899.00
- (7) IRWIN 10 meg tape B/U ..... \$649.00
- IRWIN 20 meg tape B/U ..... \$799.00
- Tape cartridges for above ..... \$34.95
- (8) External hard drive box w/power supply for hard drive or tape B/U option, w/ricables and ready to go ..... \$249.00

**HARD DRIVE BOX**

This nicely made box is ideal for externally mounted hard or floppy drives. It has space for one full height or two half height drives and power supply space at rear. This is a well made and rugged units for only \$59.95

**NEW SME-XT  
640K TO 1M BYTE**

In response to popular demand we have developed an upgrade of the famous MBE-XT board. The new board is called the SME-XT and has space for up to 1 Mbyte on board. The most popular configuration is 640K which is the IBM max addressable memory. The extra RAM above 640K is normally used for system purposes such as video lookup, ROM sitting, and other uses. However, we can supply proms to allow full use of this overhead space on demand. The 256K RAMS are more highly evolved than 64K RAMS and board we have far fewer problems with parity errors. We have decided to maintain the low-low price we pioneered with the MBE-XT and sell the new PCB at \$39.95 as well. All other attributes stay the same as the original IBM and the MBE-XT.

SME-XT Bareboard 1 Parts List ..... \$39.95

SME-XT Wired and Tested with OK RAM with BIOS ..... \$199.00

Manual and Schematic ..... \$4.95

**LAZY BOARD**

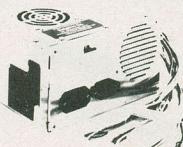
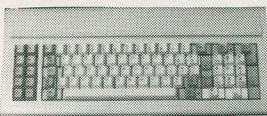
LAZYBOARD. No we are not lazy, it's for YOU!!!. We had a bunch of 640K motherboards expertly wave soldered with all solder-in parts with AMP style IC sockets but no IC's at all. You buy the IC's or use your own stock and you can get a system going really cheaply. We are selling this "LAZY BOARD" for only ..... \$119.00

**QUME**

Yes we have the same QUME drives that IBM uses in their IBM-XT® system, 40 track, 1/2 height, double sided, double density. The exact ones you need to upgrade your old system or build your clone system up to the max. These are brand new drives that are from QUME's own inventory. They are absolutely perfect, at a perfect price of only ..... \$149.00

**CABLES**

- Disc Drive cable (3 Con & twist) ..... \$12.95
- IBM Parallel printer cable ..... \$14.95
- IBM serial printer cable ..... \$14.95
- IBM 6' Keyboard extension (curly) ..... \$9.95

**KEYTRONICS 5150**

Yes the famous KEYTRONICS 5150 IBM® compatible keyboard, MADE IN USA. We bought a bunch and can sell them for only ..... \$129.00

We also have some Taiwan copies that are quite good and all are checked for only ..... \$109.00

And lastly we have some Taiwan copies of the famous KEYTRONICS 5151 keyboard with all the same enhanced features for only ..... \$139.00

**COMPUTER  
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Toronto, Ontario M5T 1S3

**DISC DOUBLER**

Just that, it doubles your discs by cutting another write protect notch on the other side of the Apple SSD diskette so the other side can be used, doubling your storage space. Note, almost all diskettes are good on both sides and the diskette packagers just label them SS or DS and sell the DS for 25% more. So spend \$8.95 and save hundreds later on.

**MODULATOR**

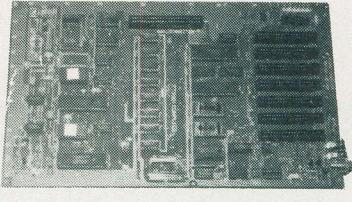
This modulator was made for the TI 99-4A that is now dead as a doornail. We bought a bunch and are selling em for \$14.95. They are a very good quality modulator for use on 12 Volts DC and have both sound and video inputs and are for color use on channel 3 or 4. They also have a built in antenna switch. They are a very good unit professionally built.

Video cable, RCA-RCA 6 feet

**CONNECTORS  
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| DB-25 M solder          | \$1.95 |
|-------------------------|--------|
| DB-25 F solder          | \$1.95 |
| DB-25 M IDC, Flat cable | \$3.49 |
| DB-25 F IDC, Flat cable | \$3.49 |
| DB-25 M Right angle PCB | \$2.99 |
| DB-25 F Right angle PCB | \$2.99 |
| DB-25 Shell             | \$ .99 |
| DB-15 M solder          | \$1.35 |
| DB-15 F solder          | \$1.35 |
| DB-15 M IDC, flat cable | \$2.49 |
| DB-15 M Right angle PCB | \$1.45 |
| DB-15 F Right angle PCB | \$1.45 |
| DB-15 Shell             | \$ .99 |
| DB-9 M solder           | \$1.35 |
| DB-9 F solder           | \$1.35 |
| DB-9 M Right angle PCB  | \$2.50 |
| DB-9 F Right angle PCB  | \$2.50 |
| DB-9 Shell              | \$0.75 |

**MOTHER  
BOARD**



100% IIe® Compatible, for those of you who wish to build a clone of the very popular APPLE IIe®. This board is a reverse engineered copy of the IIe® and is 100% compatible. We have the motherboard and the custom ICs only. All other parts are widely sold. The custom ICs are workalike chips that do not infringe any copyrights. The software for operating the board must be obtained elsewhere as we do not have it for sale. When we say 100% we mean it.

|  |         |
|--|---------|
| A very good buy at                                       | \$49.95 |
| Custom IC set(2)   | \$49.95 |
| Keyboard encoder (AY3-3600)                              | \$14.95 |
| Character generator, U/L/C                               | \$14.95 |
| 48K 6502 Motherboard, same old 100% compatible 2 + clone | \$29.95 |

**APPLE IIe®  
DETACHED NUMERIC KEYBOARD  
\$99.00**



For those of you who would like to put your IIe® in another case we have a high quality 100% plug in compatible Matrix keyboard with all IIe® keys plus the highly desirable numeric keypad for quick entry of numeric data .....

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**STEP UP/DOWN  
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- (A) 1400 WATT AUTOTRANSFORMER. Has taps for 120-220-230-240 Volt operation and is 100% new in the box. Cost Xerox over \$150.00 in large lots, your cost only ..... \$49.95
- (B) 240 WATT 120/240. This beauty has two 120 Volt primaries and two 120 Volt secondaries and can step up/step down with isolation. Each side is good for 2 Amp at 120 or 1 Amp at 240 Volts. Your cost ..... \$24.95

NOTE, due to the weight freight is extra, ask for \$.

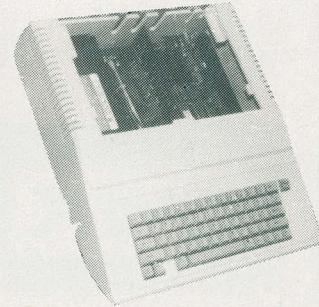
**FLAT CABLE  
DRIVE CONNECTORS**

|                             |        |
|-----------------------------|--------|
| 50 Pin Edge C, 8" drive     | \$5.95 |
| 40 Pin Edge C,              | \$4.95 |
| 34 Pin Edge C, 5-1/4" drive | \$2.95 |
| 20 Pin Edge C, Hard drive   | \$1.95 |
| 34 Pin Fem header 17 x 2    | \$1.95 |
| 26 Pin Fem header 13 x 2    | \$1.49 |
| 20 Pin Fem header 10 x 2    | \$ .99 |
| 16 Pin Fem header 8 x 2     | \$ .99 |
| 16 Pin DIP header           | \$ .99 |
| 10 Pin Fem header 5 x 2     | \$ .99 |

**CENTRONICS  
CONNECTORS**

|                            |        |
|----------------------------|--------|
| 36 Pin solder cable male   | \$4.95 |
| 36 Pin Flat cable male IDC | \$4.95 |
| 36 Pin Flat cable female   | \$4.95 |
| S-100 Edge Connectors      | \$ .99 |

**IIe® ABS PLASTIC CASE  
\$59.95**



This case is made to fit the Mother Board listed here for making IIe® clones and it makes a very nice looking copy. There is just enough difference to avoid design infringement. The case also has no brand names or other marks on it.

A good buy at ..... \$59.95

ABS numeric case for 48K motherboard. Exact fit.

..... \$49.95

or wired and tested (with cable) ..... \$19.95

or wired and tested (with cable) ..... \$24.95

**IIe® MATRIX  
KEYBOARD**



This keyboard fits the above case and has 100% clone compatibility, it will allow operation of all IIe® commands. Another bargain at ..... \$79.95

2 + numeric keyboard for 48K mother boards, 100% comp. 88 basic functions for only ..... \$69.95

Standard same as above ..... \$69.95

We have a lot of these 20 Mhz scopes that are sold elsewhere for up to \$699.00. Well we sell em a lot cheaper, only ..... \$475.00

Dual probe set ..... per probe ..... \$34.95

All cards come with a detailed parts list and placement drawing, we also have all parts needed for them.

..... \$18.95 NEW IN BOX TESTED

AC power cable (3 Wire) for above ..... \$2.50

**ASCII KEYBOARD**

This is a high quality Hall Effect keyboard made by Microswitch of Canada for AES data and now bought by us for 10% off the \$169.00 that AES paid for them in 10,000 lots. They are a very good word processing keyboard with both serial and parallel data outputs for use with APPLE and IBM type systems and come complete with a ribbon cable connector and complete pinout. .... \$24.95

**IBM POWER  
SUPPLY**

One of the nicest open frame IBM type switching power supplies we have ever seen. Came from the defunct NCR IBM compatible, runs the whole thing, has +5V-7A, +12V-3A, -5, -12-1/4A. A very good unit for starter system. Will not run hard disc system. A real Steal at ..... \$49.95

**TEACHERS**

We accept all SCHOOL BOARD purchase orders. We will provide a written quote if needed. We have access to all monitors, printers, disc drives, software etc. now sold in Canada and can quote very competitively on these items. Pls include any duty or sales tax data on any RFQ.

**INSTRUCTIONAL USE BONUS**

Any order for 12 units at regular price will be given an extra unit for instructional use. Larger orders will be pro-rated accordingly. Instructor may specify alternate goods for equal value. Pls invoke this bonus in writing at time of order referencing PO # in letter.

**SPECIAL  
10 MEG HALF HEIGHT  
HARD DRIVE  
W/CONTROLLER  
AND CABLES  
\$649.00**

**20 MEG HALF HEIGHT  
HARD DRIVE  
W/CONTROLLER  
AND CABLES  
\$899.00**

**PARTS,**

|   |            |
|---|------------|
| 8088 CPU  | \$12.95    |
| 8087 Math Processor                                 | \$219.00   |
| 9237A-5 Prog. DMA Ctrl.                             | \$8.95     |
| 8250 Serial Port                                    | \$9.95     |
| 8253A-5 Prog. Interval timer                        | \$5.95     |
| 8256A-5 P.I.P.A.                                    | \$4.95     |
| 8259A Prog. Interrupt Ctrl.                         | \$4.95     |
| 8284A ADC clock gen & driver                        | \$5.95     |
| 8288 Bus Controller                                 | \$9.95     |
| 8272 Floppy Disk Controller                         | \$9.95     |
| NEC 765 Floppy Disk Controller (equivalent to 8272) | \$9.95     |
| Set of 8088, 8255A-5, 8237A-5, 8288                 | \$28.84    |
| 8253A-5 and 8259A                                   | \$44.00    |
| 6502 CPU  | \$ 5.50    |
| 6845 CRT controller                                 | \$ 9.50    |
| 68A45 CRT controller                                | \$ 9.95    |
| Z80A CPU (4 MHz)                                    | \$ 4.95    |
| MC3242  | \$11.95    |
| 74LS367   | \$ .62     |
| 74LS259   | \$ 1.39    |
| 74LS161   | \$ .99     |
| 74S74   | \$ .82     |
| 74S174  | \$ 1.70    |
| 74LS23  | \$ 4.55    |
| Card edge connector (50 pin)                        | \$ 2.49    |
| RCA jack PC mount                                   | \$ .69     |
| 6 pin power square connector                        | \$ .99     |
| Phone jack (small)                                  | \$ .99     |
| MPSA 13 trans                                       | \$ .55     |
| 2N3904 trans  | \$ .19     |
| 2N3906 trans  | \$ .27     |
| MPSU51 trans  | \$ .79     |
| 2N4258 transistor or equiv                          | \$ .89     |
| 1K SIP 10 pin                                       | \$ .89     |
| 1K SIP 8 pin  | \$ .89     |
| 1K SIP 10 pin                                       | \$ .75     |
| 4 pos dip sw  | \$ .95     |
| 20 pin female header for disk drive                 | \$ 1.79    |
| 20 pin male   | \$ 1.69    |
| 50 pf trim cap                                      | \$ .89     |
| 220 ohm trimpot                                     | \$ .69     |
| 20 conductor ribbon cable                           | \$ .89/ft. |

**PARTS,**

**GRAY SCALE  
ADAPTER**

As you know the IBM color graphics card does not look very good on a monochrome monitor. This is because often two colors look the same on monochrome so you cannot read red print on a blue background or some such. This little gray scale proportionately scales each color into a different intensity allowing easy viewing on amber, green or white monitors. We sell it as a kit for only (with cable) ..... \$19.95

or wired and tested (with cable) ..... \$24.95

**SOCKETS  
AMP IC SOCKETS**

As you know AMP makes the best IC sockets. With a double wipe action and a very wide open target for easy insertion, the best.

6, 8, 14, 16, 18, 20, 24, 28, 40  
Pin in stock at only

**1.5¢ PER PIN**

**FEEWARE**

FeeWare?? It is public domain software that we have collected into various and are offering out at fair price considering the game effort. You can do what you like with it, set up your own resale operation in your area etc. What we offer is two sets of 4 diskettes with each one covering a general area of interest.

SET A - Communication software  
Full duplex port, 1200/300 Baud + Word processor + Keyboard Macros + Desktop environment + Help + DOS utilities + Copy programs + Many other small routines too detailed to list here.

SET B - Data Base package  
Spreadsheet, Print utilities + File utilities + Help + Games + Data Base + "C" Compiler + Languages utilities + Many other small routines too detailed to list here.

Price \$24.95 for each set  
Please specify package A or B Catalog (refundable on purchase) ..... \$20.00

**IBM BARE PCB**

|   |         |
|---|---------|
| (A) Color Graphics (Persyst)  | \$27.95 |
| (B) Monochrome graphics   | \$24.95 |
| (C) Disc controller   | \$17.95 |
| (D) Disc controller + Printer   | \$24.95 |
| (E) Disc controller + Game  | \$24.95 |
| (F) I/O + 2 I/O clock etc.  | \$24.95 |
| (G) Multifunction card 11 function  | \$24.95 |
| (H) AST SIXPACK COPY  | \$34.95 |
| (I) Parallel printer  | \$17.95 |
| (J) RS-232 card   | \$17.95 |
| (K) Simple modem card   | \$17.95 |
| (L) Disc for above  | \$ 8.00 |
| (M) 512K card   | \$24.95 |
| (N) 256K short card   | \$19.95 |
| (O) IBM 6" extender for service   | \$19.95 |
| (P) WW Proto, full sized with DB-9 & DB25 footprint   | \$24.95 |
| (Q) WW Memory proto, full sized with 256K (1Meg) memory laid out on one end with DB-9, DB25 footprint | \$29.95 |
| (R) 512K Mapping PROM   | \$12.95 |
| (S) Multifunction PROM(S2)  | \$24.95 |
| (T) 2732 for color graphic  | \$10.00 |

All cards come with a detailed parts list and placement drawing, we also have all parts needed for them.

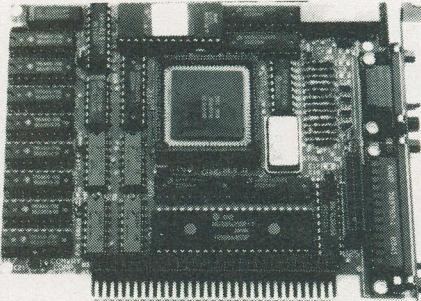
# COMPUTER PRESS

Continued from page 75

## Graphically Speaking

- Compuserve now has available two new colour graphics cards by Array Technologies.

The Graphics Solution is a multi-application video adapter which performs high resolution colour graphics and colour graphics emulation with optional serial and parallel ports, and will drive any IBM compatible RGB, composite, monochrome or TTL monitor, and retails for \$429.00.



The ATI Colour Emulation Card is completely compatible with the IBM Colour Graphics Adapter, will drive any IBM compatible colour monitor, and retails for \$339.00.

Call Compuserve at 400 Alden Road, Markham, Ontario L3R 4C1, telephone (416) 477-8088. Circle No. 33 on Reader Service Card.

Datamax has announced two new **ForteGraph** products for the IBM PCs, XTs, ATs and compatibles, which offer users interactive access to IBM's advanced All-Points-Addressable (APA) host graphics. Both ForteGraph APA and ForteGraph 3270 PC support IBM's GDDM 4.0 version of graphic software, giving PC users access to mainframe graphics.

Both products will list for \$1,195.00. Datamax can be reached at 115 Norfinch Drive, Downsview, Ontario M3N 1W8, telephone (416) 665-1808, or toll-free 1-800-387-3527.

### Circle No. 34 on Reader Service Card.

Cricket Software has just released Cricket Graph, a Macintosh software package offering colour presentation graphics and page layout for science and business. Any of eight printer ribbons or pen hues and sixteen fill patterns can be assigned, and special versions of Cricket Graph also allow for the creation of colour transparencies.

Retail price for the basic package is just under two hundred dollars American, with versions for film recorders and colour printers at just under five hundred dollars American. For local availability and pricing, call Cricket Software, 3508 Market Street, Suite 206, Philadelphia, Pennsylvania 19104, telephone (215) 387-7955.

## Communicating

- A new electronic mailbox for IBM personal computers, MBx, from *T-Comm Systems*, brings a whole range of telecommunication services to the small system operator, including such features as electronic mail, public mailbox or bulletin board, multiple read-only bulletin boards and hidden bulletin boards using secondary passwords. You can try MBx yourself by calling 416-445-4345 with your three hundred baud modem, eight bit, no parity; use the sign-on name "Guest".

The retail price for MBx is \$569.00, and it's available from T-Comm Systems, 1207-745 York Mills Road, Don Mills, Ontario M3C 2S7, telephone (416) 445-0570.

- A local area network without cables is introduced by *GridComm*. Called GCM GridNet, the system uses existing AC wiring to link different manufacturers' microcomputers, allowing up to eight node points to transmit and receive error-free data on ordinary electrical circuits while being impervious to electrical interference.

The GC-1400 smart communicator retails for \$549.00 US and the necessary GC-1100 interface for \$449.00 US. GridComm, Inc. is located at 20 Old Ridgebury Road, Danbury, Connecticut 06810, telephone (203) 790-9077.

CN!

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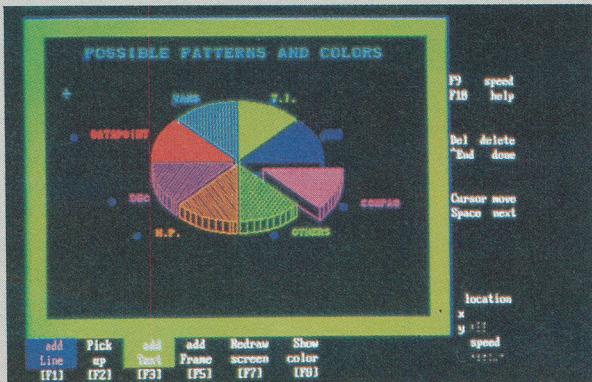
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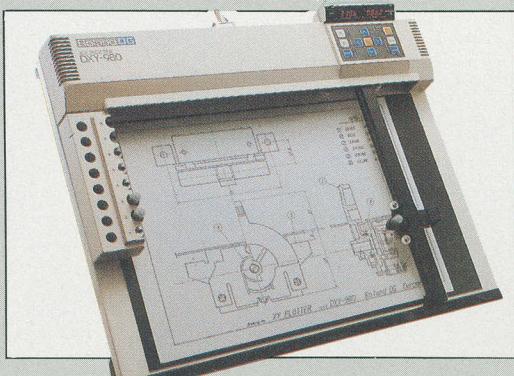
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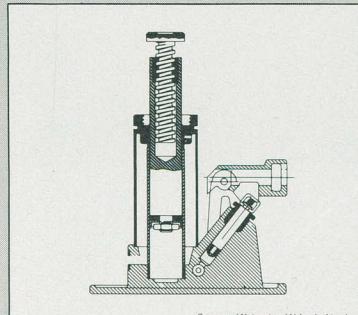
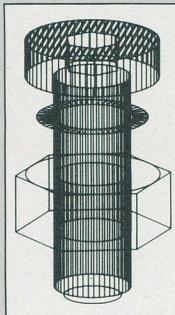


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